SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE, PUBLISHED MONTHLY

VOLUME XII APRIL, 1911 NUMBER 4

THE OPERATIVE AND SPECIFIC TREATMENT OF RENAL AND VESICAL TUBERCULOSIS

BY PROF. DR. HERMANN KÜMMELL, HAMBURG-EPPENDORF, GERMANY

Translated for Prof. Kümmell by Jno. B. Legnard, M. D., Chicago

THE diseases of the kidneys and of those organs associated with them form one of the most interesting branches of modern surgery.

In spite of the great progress which has been made during the last ten years concerning the diseases of these organs, which has enabled us to include among them those conditions amenable to surgical treatment, there yet remain many problems to be solved, many facts to be confirmed. Otherwise, how can it be explained that such an apparently small and limited field could have separated itself from the great realm of surgery and have developed into a special branch of science?

In spite of the assistance derived from our complete laboratory methods and our efficient means of testing the functional activity of the kidneys, we still meet with difficulties which cannot be thrust aside.

This is especially the case in tuberculous affections of the kidneys. Undoubtedly, they are among the most difficult conditions to diagnose, yet as far as treatment is concerned, they are among the most favorable of those pathological renal conditions which border on the realm of surgery. The diagnosis of tuberculosis of the kidneys has always been difficult on account of the many forms of this disease with which we meet. It may be present as a beginning tuberculosis of the papillæ and hæmorrhages, which, persisting for years, may be the primary symptoms of the disease. On the other hand, we may find miliary tubercles or large caseous foci scattered throughout the organ. Finally, we meet with those forms in which mixed infection has occurred, with resultant abscess formation and more or less destruction of the entire organ. Furthermore, the diagnosis is rendered more difficult by the fact that, although the first subjective symptoms experienced by the patient, or the first objective symptom discerned by the examiner, point to an affection of the bladder and the primary seat of the trouble is not sought for in the kidney, but in some other location. It may be in the bladder itself or in some tuberculous focus of the genital tract.

By thorough study of tuberculosis of the urogenital organs, we have learned that primary tuberculosis of the kidney does exist and that from this source the infection of the ureters and of the bladder occurs. It was evident that by early removal of the infected foci, the remaining parts of the urinary tract and its associated organ could be saved from secondary infection or from irreparable destruction.

Of the 125 cases which I have operated for tuberculosis of the kidneys, I have demonstrated that secondary infection occurred by way of the blood stream, from primary

lesions situated in the lungs, infected glands, and in one case from an anatomical tubercle, located on a finger. In other cases, there were often no demonstrable lesions in the lungs or other organs, and the bladder and kidneys alone were found to be involved. As long as tuberculosis of the kidney was regarded as the result of an ascending infection from the bladder, it was only in a limited number of cases and under special conditions that a successful operative interference could be resorted to upon a secondarily infected organ. These views were later disproven, both by the numerous scientific investigations of Baumgarten, Kramer, Steinthal, and others, and by pathological findings and clinical observations.

The interesting animal experiments of Baumgarten, Hauser, and others, demonstrate conclusively that the extension of a tuberculous infection follows the course of the lymphatics; consequently, in case of a primary tuberculosis of the kidney, the infection descends along the ureter to the bladder.

A primary infection of the testicle ascends along the vas deferens to the seminal vesicles and to the prostate, thereby disproving the reverse theory, that of "infection extending 'against the stream.'" We know that *the kidney is the primary site of a tuberculous infection of the urinary tract and that from this focus the infection gradually extends to the ureter and bladder.*

We also know that in case of a widely disseminated tuberculous infection of the genital organs, as for instance, the testicles, prostate and seminal vessels, the bladder may become involved secondarily, although this occurs less frequently. On many occasions, it has been observed that a tuberculous infection of the kidneys and of the genital organs may exist simultaneously, but it is from the former that the bladder becomes involved. If tuberculous infection of the genital organs and of the bladder are present at the same time, it is to be assumed that a lesion of the kidney also exists. Thorough examinations have always confirmed the assumption *that if two different tuberculous infections were present, each had its origin in a different primary focus.* I have had several opportunities to confirm this statement.

In that more frequently operated form of tuberculosis of the female genital organs, which leads to extensive involvement of the peritoneum and to the development of ascites, I have hardly ever had an opportunity of observing a single case in which the bladder showed signs of invasion, unless a tuberculous infection of the kidney was present at the same time.

Tuffier's theory, that in those cases of bilateral renal tuberculosis, one kidney becomes involved secondarily, in consequence of the infection extending upward from the bladder, may be possible but not probable. Those cases of bilateral renal tuberculosis which I have observed, seem to show that infection of the two organs occurred simultaneously, even though the symptoms of the disease of the one side overshadow those of the other. Still by far the greater evidence is, as we have observed from clinical experience and the long convalescence after removal of the diseased organ, in favor of a unilateral tuberculosis of the kidney. In a great number of those cases, in which the tuberculous infection of the kidney has caused marked changes in the bladder, even a contracted condition of the same, the second kidney very often remains unaffected. In spite of the possibility that the process may have ascended from the bladder to the second kidney, an early removal of the diseased kidney is permissible.

The gradual invasion of the bladder by a tuberculous infection from the kidney, may be observed with ease. In the beginning stages of a tuberculous cystitis, the cystoscope reveals little ulcerations surrounding the ureteric opening on the same side as the diseased kidney, while the mouth of the ureter, and the surrounding mucous membrane of the opposite side, are free from such lesions. As a result of further contact of the mucous membrane with the tubercle-bacilli-laden urine, one may observe in the more advanced stages of the disease, an extension of the ulcerations and a gradual involvement of the lining membrane of the bladder.

Many years ago, when we regarded tuberculous cystitis as a primary infection, I had an opportunity to observe one case in particular, which was instructive in many ways. A circumscribed tuberculous ulcer, in an otherwise healthy bladder, was excised, the site healed, but later it was discovered that the kidney was the primary seat of the infection.

In 1894 a 26 year old woman came under my care, complaining of frequency of urination, and was voiding turbid urine. There was no pain over the kidneys. Few tubercle bacilli were discovered in the urine. Cystoscopic examination revealed below the right ureteric opening, an oval shaped ulcer about one and one half cm. long and one cm. wide. This was looked upon as the source of the tubercle bacilli which appeared in the urine. The bladder was opened by the "sectio alta," the ulcer excised and the edges of the wound approximated by sutures. An uneventful recovery followed. Cystoscopic examination revealed a complete restoration of the bladder mucous membrane and healing of the intravesical wound. As we believed in primary tuberculosis of the bladder at that time, we thought, after the radical excision of such a circumscribed tuberculous ulcer, that a complete cure would be effected, and especially so since the case had come under treatment during its early stages. Several months later this patient returned for treatment. She was voiding cloudy urine and complained of pain in the *left* side. Her general condition was poor. Examination of the bladder revealed a moderate cystitis but no tuberculous ulceration was discovered. The *right* kidney was greatly enlarged and painful on palpation. On February 15, 1895, this kidney was removed. The organ was almost completely destroyed by many abscesses and caseous foci, only very little normal tissue remaining. The patient made a rapid recovery. Since then, she has remained well and has been able to perform her usual work. In this case it was regarded as of diagnostic importance that the symptoms, which developed after the first operation, referred to the kidney, and that the seat of the trouble could be recognized by palpation.

I mention this case in detail, because it dates back to the time when we were beginning to remove tuberculous kidneys with success, although many prominent surgeons were energetically warning us against operation.

In 1895 such an eminent surgeon as Albert of Vienna, wrote thus: "In conclusion, I wish to say that the performance of a nephrectomy for tuberculous affections of the kidney, is a mistake of the times and one to be warned against. There are men who have performed this operation and one case is said to have been successful." At that time, I had already removed four tuberculous kidneys. The first was in January, 1888. In each case the recovery was permanent, and to-day all the patients are living, or at least they were up to a short time ago, and are well. In the early stages of tuberculosis of the urogenital tract, conditions are by no means always so favorable as to point to the primary seat of the trouble and it requires most thorough and careful examinations to enable us to recognize the affection, and particularly so at that time when no distinct symptoms of the disease stand out prominently.

As in all other diseases, *and especially so in tuberculosis of the kidney, an early diagnosis is of the greatest importance for the carrying out of a successful treatment.*

I should designate as *the earliest stage of tuberculosis of the urinary organs,* that in which the subjective symptoms do not refer to the seat of the trouble, and such objective diagnostic signs as enlargement and tenderness of the organ are absent, the pathological changes are limited to the kidney, and the ureter and bladder are either uninvolved, or if so, only in the slightest degree. Such a condition, which I regard as a primary tuberculosis of the kidney, responds most favorably to treatment. Early removal of the kidney is usually followed by a short convalescence and complete recovery.

If a tuberculous cystitis is present, recovery follows the removal of the diseased kidney, provided the function of the second kidney remains unimpaired. We know only too well what suffering a patient with a tuberculous cystitis endures from the time of the development of the first symptoms of a vesical catarrh, namely, the slight frequency of urination, to the almost complete incontinence or continuous dribbling of the advanced stage of a contracted bladder.

We also know how intolerant a tuberculous bladder is to local treatment, irrigations of any kind are exceedingly painful, the reaction

following the use of solutions of copper sulphate is most marked, and operative procedures prove ineffective. It is also difficult to understand how any such surgical measures as curetting, excision, or cauterization of the lesions, can be followed by more than temporary relief, since new infection occurs from the tubercle-bacilli-laden urine, coming from the infected kidney. Tuberculosis of the bladder, which is a secondary infection, should never be treated surgically. Early treatment should be directed toward the cause of the disease, namely, the infected kidney.

Even in those advanced cases of tuberculous cystitis which were accompanied by most intense suffering, or even in those cases in which a high degree of contraction of the bladder was present, excellent results followed nephrectomy, although the bladder received no further treatment. The patients recovered, the vesical symptoms either subsided or, in the severest cases, greatly moderated.

The quickest and most favorable results are obtained by early removal of a tuberculous kidney before the bladder becomes involved. In order to accomplish these results, the diagnosis must be made during the first stages of the disease. It is necessary to recognize early, and to interpret correctly, the first symptoms that appear. Often a tuberculous infection of the urinary tract remains latent for a considerable length of time, or it may run its course, presenting only mild subjective and somewhat indefinite objective symptoms. The latter are often misinterpreted. In many of the cases which came under our observation during the early stages of the disease, the first symptoms complained of referred to disturbances of the bladder. In each case, the examination revealed a *slight turbidity of the urine*. In some instances, the patients themselves had discovered this condition, often by chance, while in others, their physicians had been the first to observe it, although there had been no such subjective symptoms as frequency, burning, etc., which pointed to an abnormal condition of the bladder.

Frequent and very thorough examinations should be made of every urine showing any abnormal constituents, and especially so in the case of women. One should not content oneself with such a diagnosis as "catarrh of the bladder," but should attempt to discover the cause of the same.

My experience teaches that every case of cystitis, in women especially, which cannot be attributed to a gonorrhœal infection or to infection introduced by a catheter, should be suspected as tuberculous and calls for repeated and thorough examinations for the tubercle bacillus and the employment of whatever other modern diagnostic resources we have at hand. Also, in every case of chronic gonorrhœal cystitis one should look for tubercle bacilli, since gonorrhœa is a factor of etiological importance in the consideration of later infections.

In almost all of our cases we have often succeeded, after repeated examinations, in demonstrating the bacillus tuberculosis, and thereby confirming the suspected diagnosis.

Oftentimes, a cloudy urine without other subjective symptoms of a cystitis, is the only symptom which points to a disturbance of the urinary system. In addition to this condition, changes in the lungs, enlarged glands, or other symptoms suggestive of a possible tuberculosis, increase our suspicion of a tuberculous infection of the urinary organs.

In one case, that of a 24 year old woman, a very slight cloudiness of the urine was the only symptom which pointed to a possible vesical affliction. Palpation revealed nothing. It was only after catheterization of the ureters that tubercle bacilli were discovered in the urine coming from the left kidney. The kidney was removed and the patient is at the present time enjoying perfect health. The kidney on examination showed extensive destruction, due to a tuberculous infection.

I removed an exceptionally small kidney from another patient, a 45 year old woman. Many tuberculous foci were found scattered throughout the kidney substance. The only symptoms complained of by this patient were a feeling of weakness and lassitude. Previous to this time she had been under-

going treatment for "some gynecological trouble," but without improvement. Her urine was cloudy and contained tubercle bacilli. A mild cystitis was present, no ulcerations were discovered in the bladder. Ureteral catheterization revealed a tuberculosis of the right kidney. Complete restoration to health followed the operation.

Often one meets with cases with subjective symptoms which point to disease of the *pelvic organs*, instead of the urinary organs. This leads many patients to consult the gynecologist. Since a tuberculous cystitis and nephritis may run a "latent course" in the beginning stages of the disease and cause but few characteristic symptoms, it is quite common, in the case of women, to attribute their complaints to a diseased condition of the reproductive organs and to treat them for a long time for such troubles. Stoeckel has called particular attention to this fact and I can confirm his observation most emphatically.

Slight disturbances of the bladder are often attributed to a possible retroflection of the uterus, a slight cystocele, or to affections of the adnexa, and patients are treated for such, while the proper attention is not given to the bladder itself. The gynecologist should examine most carefully the urine of every patient presenting symptoms of vesical irritation, and should not consider a slightly cloudy urine as evidence of a mild "catarrh" of the bladder and treat the patient for such, but he should make every effort to discover the cause of this condition. I have operated upon many women, with advanced renal and vesical tuberculosis, who had previously undergone long courses of unnecessary treatment at the hands of gynecologists. Such inadequate treatment can only be followed by results which are invariably detrimental to the patients.

It is known that gonorrhœa, in both the male and female, is an important predisposing etiological factor in the later development of tuberculosis of the urinary organs. Among our patients we repeatedly meet with a history of gonorrhœa. Other observers, as well as I, have seen a tuberculous orchitis follow a gonorrhœal epididymitis. It is obvious that a tuberculous infection may be overlooked in a male who is afflicted with a chronic gonorrhœa, or in a female with a "cervical catarrh" due to the same cause.

The following interesting case came under my observation. The only symptom this patient complained of was a slight frequency of urination. Examination showed a somewhat pale but well nourished woman. Lung findings negative, urine cloudy. For a long time she had had an inflammation of the cervix, which was followed by a gonorrhœal cystitis. Local treatment had been ineffective. In spite of the long duration of the disease there were no vesical symptoms of note. Cystoscopic examination revealed a small ulcer on the lower edge of the left ureteric opening. It was only after catheterization of the ureter that a positive diagnosis of beginning tuberculosis of the left kidney was made. The extirpated kidney showed that the operation had been performed during the earliest stage of the disease. Only small foci were seen in the kidney substance, while a few miliary tubercles were scattered over the mucous membrane of the kidney pelvis. The ureter was practically normal. The operation wound healed rapidly.

In the above briefly described group of symptoms, the changes in the appearance of the urine stand out most prominently. Disturbances of the act of urination, abnormal frequency and pain on urination, are less common, while *cloudy urine or other changes in the normal appearance of the urine* occur more frequently. These changes were often discovered accidentally by the patients, or by the physician in the course of a thorough examination. The subjective symptoms were slight. Often they were entirely lacking, especially those which referred to the kidney.

In another group of cases we find more often disturbances in the general conditions of the patients. They look badly, complain of lassitude, loss of eyesight, or of other general symptoms which arouse our suspicion. Often we fail to diagnose *an affection of the urinary system* or even to suspect such a condition, on account of a hasty or *super-*

ficial examination of an apparently clear and normal urine. As an example, I cite the following: A patient came to my clinic, seeking treatment for some slight trouble of the leg. Her marked pallor and wretched condition led us to seek the cause. A few bacilli were found in the urine. Ureteral catheterization revealed a tuberculous kidney. This was removed and the patient recovered. It was surprising to find so few changes in the urine and practically normal bladder, while such widely disseminated destructive processes were present in the kidney. Caseous areas, varying from the size of a pea to that of a hazel nut were scattered throughout the kidney substance. Isolated miliary tubercles covered the somewhat dilated kidney pelvis.

If such a far advanced destructive process of the kidney can be present, as in fact it was, and yet produce such relatively slight symptoms, it signifies that such a condition may develop quickly in individual cases, attract no notice to itself, and finally extend its destructive process to the bladder. There is no doubt that in some cases a primary renal tuberculosis may remain latent for a long time without producing any symptoms. According to Kramer's investigations, it may remain hidden, until the later years of life, and then be aroused from its slumbers and urged on to further advances. These relatively far advanced cases may offer at first but moderate symptoms. Foremost among them we find a slightly turbid urine, mild symptoms referring to the bladder, especially in women, and occasional pains in the region of the kidneys. The general condition of the patient is often poor, brought about by some unrecognized cause. In such cases a most careful examination for the presence of tubercle bacilli in the urine should be made, and every other means at our command resorted to, to establish a diagnosis. A positive diagnosis should not be deferred until a tumor is felt in the kidney region, or high fever, and symptoms of severe vesical involvement develop. In such cases it is doubtful if permanently favorable results will follow an operation. Those patients which I have operated and who to-day are enjoying a restoration to health, demonstrate that the earlier the diagnosis is made and the operation is performed, the more favorable are the prospects for a permanent cure. Provided that the ulcerations in the bladder have not progressed too far, healing follows the removal of their cause. The most certain and quickest results follow the removal of the tuberculous kidney in those cases where the bladder is but slightly or not at all involved. On the other hand, we occasionally meet with cases in which extensive lesions are present in the bladder, the ureter is infiltrated and tuberculous nodules fill the pelvis of the kidney, and yet but few small caseous areas are present in the kidney substance itself.

On account of the few, somewhat indefinite symptoms which the first stages of infection of the urinary organs produce, the early diagnosis of a beginning tuberculosis is attended by many difficulties. These, however, we have overcome. In the more advanced forms of vesical and renal tuberculous infections, the diagnosis is not so difficult, especially when the patient is emaciated and cachectic, the kidney is enlarged and painful, the ureter feels thickened to the touch and frequency and pain on urination are present. To these symptoms may be added variations in the temperature curve and the voiding of purulent, turbid tubercle-bacilli-laden urine. A positive diagnosis may be made with ease in these cases. It is in the beginning stages of the disease, when the individual symptoms are least pronounced, when no pain is present, when there is no enlargement of the affected kidney, or when the ureter is not involved or shows no thickening on palpation, that we must be able to make a correct diagnosis of this disease.

One can realize from the characteristic paradigms which have been taken from a great number of analogous cases, that even by the most careful palpation under most favorable circumstances, viz., lax abdominal wall and thin individuals, it is impossible to feel these changes within kidneys which are not enlarged and which, even after the kidney has been removed, are not to be recognized until the organ is dissected.

It is well known that tubercle bacilli even in tuberculous kidneys are not always to be demonstrated, because the tuberculous foci at the time are not in communication with the urinary passage.

It is often necessary to examine many specimens before even a few single bacilli can be demonstrated. The demonstration of tubercle bacilli is always the surest and most important diagnostic point in determining tuberculosis of the urinary organs.

We have been able by animal experiment and by the employment of various methods in the examination of sediment from large amounts of urine, to demonstrate the presence of tubercle bacilli in all cases, especially in early stages of the disease. Differentiation from smegma bacilli is made by proper staining methods, as well as by sterile collection of the urine. The presence of tubercle bacilli in the urine proves only that we have to deal with tuberculosis of the urinary apparatus. Whether it be secondary, more or less widely disseminated disease of the bladder, the source of which is the kidney, whether both kidneys are diseased, or whether one is sound, we do not know; neither can it be determined by our usual clinical methods.

These difficulties in the diagnosis can be overcome by the use of the cystoscope, and above all, the catheterizing cystoscope. In advanced cases the cystoscope reveals a more or less widespread ulceration of the bladder. In the early stages, with infectious material descending from the kidney, we see in the region around the ureteral opening of the diseased side, small characteristic tuberculous ulcers, or at times, an ectropion with scalloped and roughened edges, often an irregular funnel shaped ureteral orifice. In general, it is a very characteristic picture and is not to be mistaken.

If, however, we have to deal with primary renal tuberculosis without clinical symptoms before the bladder has become affected, the cystoscope alone is of no value, but ureteral catheterization, which is the greatest triumph of cystoscopy, surely and quickly enables us to arrive at a complete diagnosis.

The use of dyestuffs, as recommended by Schwalbe, Achard, and others in renal diagnosis, especially the use of indigocarmine as used by Völkers and Joseph in chromocystoscopy, was a marked improvement in technique. It is of especial advantage to the beginner, as the stream of colored urine marks the exact location of the ureteral opening, and even to the experienced, in cases of advanced ulcerative cystitis, as we so often see in tuberculosis of the bladder, it reveals frequently the hidden opening in an ulcerous field. It also proves the presence of two ureteral openings, likewise two kidneys and also whether they both secrete urine or not.

The possible escape of urine around the catheter already placed within the ureter is also easily seen by the presence of colored urine. Chromocystoscopy is a harmless procedure in most cases but it is to be deplored that at times it gives inconstant results, viz., that at times in the same individual suffering from renal tuberculosis the excretion of coloring matter is delayed for hours, while one or two weeks later, the time of beginning excretion from the healthy kidney may be nearly normal, i. e., 15 minutes.

The danger of simple infection following ureteral catheterization has been repeatedly pointed out, but we have never seen such an infection following the passage of a catheter into the ureter and our observations cover many hundred cases which have remained continuously, weeks and even months, under our care.

The indigocarmine method should not be taken to render the ureteral catheterization unnecessary, as we know that both kidneys secrete urine, one perhaps more than the other, and by that method no estimate can be made of the relation which the function of one kidney bears to the other regarding consistency, concentration of urinary solids, or molecular state. Such relation can be made from urine recovered from each kidney by means of a catheter. This is necessary before every kidney operation. We must know with certainty whether the remaining kidney is healthy and is able to carry on the work of both organs. The ureteral catheterization and rigid examination of urine from either kidney, will show this positively. A single examination of urine re-

covered from the bladder after the mixture of urine from both organs has taken place, and the estimation of functional activity, seem to be uncertain.

The danger of infection by careful catheterization is very slight. *It is absolutely necessary for an early diagnosis, as we do not know which kidney is diseased*, especially if there is no ulceration around the ureteral openings, no pain, and no palpatory findings point to the seat of the trouble. On the other hand, there is great danger of mistake, especially in extensive ulceration of the bladder. Several times I have catheterized an apparently healthy ureter, there being wide spread ulceration around the orifice of the other side. The urine as it flowed from the catheter was macroscopically clear, of yellow color, and apparently from a healthy kidney, while the urine escaping at the same time from the other ureter into which no catheter had been passed, was cloudy, contained pus, and was bloody. The examination demonstrated tubercle bacilli in the *clear* urine. Catheterization of the other ureter resulted in the collection of a urine which on examination showed a perfectly healthy kidney. The operation proved the accuracy of the diagnosis.

The indirect method (other than ureteral catheterization) is not positive in results obtained, as the urine is contaminated by the secretion from the ulcerated bladder. This accounts for the uncertain results obtained by the use of the segregator. The knowledge gained of the functional activity, state of health, and fate of the kidney which is to remain, is the achievement of this new method in renal diagnosis.

The use of the method is rapidly increasing and I am certain that any surgeon who employs ureteral catheterization and becomes proficient in it and can thereby accurately estimate the functional activity of the kidneys, will become an ardent advocate of it. Those who oppose it must be placed in the class with those who have not sufficiently mastered the technique. Improvement in technique as well as the liquidation of many mooted points, will, without doubt, be achieved by further observation and general individual use of it.

In tuberculosis of the urinary tract, the catheterization of the ureters is not to be omitted, especially in early diagnosis before bladder symptoms and other objective diagnostic signs and symptoms point to the kidney as the seat of disease.

I must take exception to some authors who hold ureteral catheterization in vesical and kidney tuberculosis as unnecessary or even not without danger. There is no disease of the kidney in which we can so ill afford the omission of the ureteral catheter as in tuberculosis. I have never seen untoward results follow its use. The difference between the urine excreted by a tuberculous kidney and that by a healthy one is macroscopically very striking. The tuberculous urine is usually light, clear, and watery, while that from the healthy kidney is of known color and constitution. We know which is the diseased kidney, and we are able to determine by estimation of density and freezing point, by estimation of urea and allied substances, whether much normal kidney substance is present, or whether the process is far advanced. We establish by the same method, the soundness of the other kidney and its ability to take over the work of the one to be extirpated. Even when one kidney is not perfectly sound, we have undertaken to remove the one *most* diseased, after it was determined that the remaining one could carry on the work. In advanced cases of vesical tuberculosis, with contraction of the bladder, even to a capacity of 50 to 80 gm., in which the ureteral catheterization is very difficult, I have almost always been able to carry it out. In early stages of the disease the technique is not difficult. By the use of eucaine and antipyrin or even by subcutaneous injection of scopolomine and morphine, the pain can be reduced to a minimum. Only for children, girls about ten and boys about fourteen years, do we think narcosis necessary and in these cases catheterization gives us certain knowledge regarding each individual kidney. When we have catheterized the diseased kidney and find the urine from the other kidney, collected by the indirect method (not through the catheter) normal, we do not catheterize the sound kidney. When

it is impossible without the catheter to demonstrate with certainty that the kidney which has not been catheterized is perfectly normal as to function, we catheterize this one as well, and up to this time we have never seen any damage resulting therefrom. Practical experience has not borne out the theoretical considerations regarding infection, etc. It is to be deplored that at times in spite of all experience and practice, it is *impossible* to pass the catheter, and in these cases, as well as the others, we must arrive at a positive diagnosis in order that we may employ a proper therapy. How may this be done? I prefer to divide the cases of renal tuberculosis into three groups, according to the different stages of the disease. The first group comprises the cases mentioned, in which we are able to *operate early*. To the second group belong those cases in which the results of ureteral catheterization demonstrate not only that one kidney is badly diseased but also that the other one is not intact. The poor condition of the patient and the presence of fever demand operative interference, but it is a question whether the kidney which is as yet but slightly affected will be able after the nephrectomy, to carry on the work of both. Besides, the well known methods of determination of kidney function, the estimation of urea and cryoscopy, and especially the determination of the freezing point of the blood, are of inestimable service. This has never failed to be of service to us. If the freezing point is normal (−0.56,− 0.57) we cut down upon the badly diseased kidney. If it is greatly destroyed, we take it out, and have always seen that the other was able to carry on the function of both. From our experience, we draw the conclusion that the one kidney is not able to excrete the products of tissue waste and that the favorable freezing point of the blood is maintained or due to the sufficient function of the other.

If the freezing point of the blood is below 0.6, we do not forego operative interference even though other things speak against operation, but we lay the diseased kidney free and *make a nephrotomy*, removing the tuberculous and septic masses, and tampon the kidney. Thus, in the course of time, the relatively sound kidney takes over the work of the badly diseased one, as shown by the return of the blood to a normal freezing point, and the kidney upon which the nephrotomy was done, is removed, as we have successfully done in a small number of cases and the patients for a year and over enjoyed relatively good health.

The third group comprises those not infrequent cases of tuberculosis, in which on account of the contracted bladder, extensive ulceration, uncontrollable incontinence, or youthful size of the urethra, it is impossible to pass the ureteral catheter or even a cystoscope. As before mentioned, I have been able to carry it out many times when the bladder has a capacity of 50 to 80 gm., but in others, when the bladder would retain nothing or when some such conditions as mentioned were present, it was impossible. In some of these cases, even in widespread disease, where there was nothing to point to the affected side, such as enlarged or tender kidney, we have been able to palpate an enlarged ureter, the freezing point of the blood being previously determined. If the freezing point was found to be within normal bounds we laid the suspected kidney free; if it was found to be widely destroyed, as was usually the case, a nephrectomy was done and according to our observations, the other kidney was able to carry on the work. In this class also, we have had no failures, as the remaining kidney has appeared healthy and of normal function. If the freezing point was under 0.6, we recognized that both kidneys have a normal function, and at that time there was at least insufficiency of one of them. In this case, we did a nephrotomy upon the one suspected to be the most badly diseased and removed the diseased tissue following with tamponade. If the other kidney recovered and functionated properly, the normal freezing point of the blood returned and later we could do a nephrectomy. If the freezing point remained low and if the urine secreted by the unoperated kidney remained purulent, or if the fever continued and indicated operative interference, we

could have done a nephrotomy upon the other side.

Patients with double sided disease usually pass away within a few weeks or months. By observing these cardinal points and above all, the cryoscopy of the blood, we have been able in these severe cases in which ureteral catheterization was impossible, to make a positive diagnosis. Cryoscopy must never supplant the other methods but must be used rather to round out the diagnosis and in those cases in which catheterization fails, it will do it most satisfactorily. In other cases the freezing point of the blood seems to be an index to functional ability, and if below 0.6, will warn us before a nephrectomy. An exact diagnosis is necessary in order that a proper therapy may be carried out, and the proper therapy according to my own rich experience and study of so many cases which in my own hands have turned out so favorably, is along surgical lines. The following are the results obtained in 125 cases of renal tuberculosis: Seven of these were nephrotomies on account of double sided disease, one woman having a double sided nephrotomy; of 118 nephrectomies, on acccount of one sided disease, 12 were operated before the employment of the new method of examination, with three deaths, one from peritonitis, with embolism, and one, congenital kidney defect. After the employment of ureteral catheterization and estimation of functional activity, 106 nephrectomies were done with a mortality of four (one pneumonia, one sepsis, one myocarditis, one miliary tuberculosis). Within the first 6 months 18 succumbed; in the course of the next two to four years, 18 of the remaining 84 died; in the course of the next 10 to 13 years, none have died; three have died, time elapsed unknown; from four patients we have had no reports; the remaining patients report as being in good health; three of them have become pregnant and have been delivered; twenty-five are still under treatment.

What are the results following the medicinal treatment of renal tuberculosis? It would assuredly be of great advantage to be able to avoid a bloody operation upon a vital organ, if by medicinal treatment it could be restored to normal and the patient returned to a general healthy condition.

Before we enter into the discussion of a specific treatment for renal tuberculosis, we must consider the following, namely: Is a spontaneous "healing out" of renal tuberculosis possible, and has such a case been observed? I formerly reported a case of a 39 year old man whose extirpated kidney showed the remains of an old tuberculous process. Thirteen years previously the right testicle was removed on account of tuberculosis. Since then he has been free from all complaint referable to a urinary tuberculosis. Seven years previous, he was six months under treatment for gonorrhœa and cystitis, two years before he had acute inflammatory rheumatism, and in the last six months has had painful micturition, frequency of urination, and has had hospital treatment for a long time without result. For the last six months he has been worse, having general weakness and a dull pain in the back. Careful examination gives the following: Patient rather anemic, quite well nourished, without pathological lung findings, kidney not palpable, in left kidney region slight tenderness, urine cloudy, much pus, no tubercle bacilli. Cryoscope: s-0.56, Δ-1.42, U -19.6. Cystoscope: Bladder mucosa injected. Left ureteral opening surrounded by a reddened area; right ureteral opening, normal. Ureteral catheterization: Right kidney. Freezing point of urine, 1.5; urea, 23; urine, clear. Microscopic: Only an occasional single red blood cell. Left kidney: Freezing point of the urine, 0.9; urea, 7; urine, cloudy. Microscopic: Many pus cells; no tubercle bacilli. Operation: Nephrectomy of left kidney, which was normal in size, very uneven surface; the protuberant areas were of yellowish color, between which were deep furrows having a granular surface; some cystic formation. Upon dividing the organ it was seen that the yellowish, swollen areas were due to smooth walled cysts containing homogeneous masses and having no communication with the pelvis of the kidney. The cortex was practically of normal thickness. Under the contracted areas the cortex was

much thinner. The cysts, especially around their bases, were surrounded by kidney tissue. There was a well marked line between the cortex and the medulla; papillæ normal; mucous membrane of pelvis, quite normal. In some places were many small, grayish white bodies, arranged in rows within the mucous membrane which was intact over them. They were all of about pinhead size. Microscopic examination of the nodules showed them to be collections of lymphoid elements and not tuberculous, having no epithelial border and no giant cells. The cystic walls were not lined with epithelium. Only at times did one see single cuboid cells at the outer border, which somewhat resembled epithelial cells. The cortex contained many reddened glomeruli, enlarged canals filled with hyaline masses, in some places, infiltrations of round cells. In other areas, some development of connective tissue, no areas resembling tuberculosis to be seen. In some single areas of the cortex were nodules composed of connective tissue threads, with epitheliodal cells. In some places were giant cells, whose nuclei, however, were irregularly placed. The anatomical diagnosis was: *remains of an old tuberculosis*, and called a *healed-out tuberculosis* by our pathologist. Eckehorn reports a similar case — a woman who was treated eight and a half years in the Sunswaller Hospital. During the first treatment in 1901 it was noted that she had decided symptoms of renal tuberculosis with some bladder symptoms. A large number of tubercle bacilli were found in the urine. It seemed at that time that the tuberculous process in the kidneys was in an early stage; operation was advised, but the patient objected. In 1909, she returned to the Hospital but not because of trouble with the urinary apparatus. She felt perfectly well and the urine showed nothing pathological. Ureteral catheterization showed a normal left kidney but a diseased right one. Nephrectomy was done. The kidney had changed into a multilocular sac, which was filled with thick detritus. So far as the examination showed, the contents were aseptic. Tubercle bacilli and other bacteria from the urinary tract were not to be found, notwithstanding that the ureter from the sac to the bladder was not closed. In this case also, it is most certain that the previously diagnosed tuberculosis was responsible for the destruction of the organ.

Von Rimer quotes three cases of spontaneous healing of tuberculosis, in which he later performed nephrectomies: One was a young woman with isolated renal tuberculosis, meaning that there was only the focus of tuberculosis to be recognized in the body, in which spontaneous healing followed scar formation or calcification of the contents of the cavity, but the healing was always incomplete. With the scar formation began a stricture of the ureter and the organ lost its function. At the same time the bladder was infected through a descending process. It was surprising that after the late removal of an almost healed-out tuberculous kidney, the patient quickly began to take on weight.

I have called these cases to your attention in order to show that spontaneous healing of renal tuberculosis has been observed and that with this healing there is little, if any, of the functionating organ left. Pyonephrotic sacs do occur in which, on account of the mixed infection, the tubercle bacilli are destroyed, but a diseased organ remains which infects the bladder and as such, is harmful to the patient, and only after extirpation of it does the patient regain health.

These cases teach that a urine free from tubercle bacilli does not always signify two healthy kidneys and that one should in all cases demonstrate the patency of both ureters, as a tuberculous kidney or even a pyonephrosis may lie behind a stricture of the ureter. These cases also point out that the apparent subjective and objective improvement may be very deceptive and that a spontaneous healing, in case it does occur, is of slow progress, incomplete, and often results in destruction of the organ and is often complicated by an infection of the bladder. An early removal of the affected organ offers a more rapid recovery than waiting for an apparent and deceptive spontaneous healing.

I will not go further into the medicinal treatment of renal tuberculosis, except to

say that the general treatment, climatic and dietetic, as well as the well known more specific methods are beneficial, either with or without operation. Also the treatment with various medicaments — cinnamon, guaiacol, and others. Dandag, of Brussels, reports 35 cases treated with hetol injections, without operation with very good results. The tubercle bacilli disappeared and the patients grew stronger. The results of these methods are generally not very favorable. Blum has reported a series of very interesting cases from Frisch's urological clinic, giving the results of medicinal treatment of renal tuberculosis. Of 40 cases diagnosed as renal tuberculosis, it was possible to follow up 26 of them; 24 died and 3 are still living, but suffer a great deal from bladder and kidney disease. In almost all of these medical cases, operative treatment was objected to, either by the patients themselves or by their parents, or the disease was double-sided or so far advanced that surgical measures offered no relief.

It seems that specific treatment with tuberculin gives more favorable results. Lately since this question has been brought more and more before scientific bodies for discussion, I desire to repeat the question, "Has a 'healing out' of a renal tuberculosis through tuberculin injection been seen objectively, and are we justified in using it in cases where it seems to be indicated?" Single favorable results, that is, lasting results in renal tuberculosis have been reported by Schede, Fenwick, and Rosenfel, but in these cases we cannot be positive that a previously diagnosed case of renal tuberculosis had healed out, inasmuch as it has not been proven by later autopsy or operation, because it cannot be said to be healed out when the general condition of the patient is improved over a long period and the urine is clear from tubercle bacilli.

I have had the opportunity to observe many years afterward, some cases which had been diagnosed as healed, and have found how the patient may be generally in better health, but found also that the process had gradually progressed to contraction of the bladder and incontinence. Up to this time, those cases reported by Lenhartz, Pielecke, Leedham-Green and Karo, lack in a scientific sense anatomical proof of a complete cure. Only after a number of years of perfect health would we be justified in declaring that they were permanently cured.

I grant that the cases of Leedham-Green and Karo, which were in children, seemed to be very favorable. Tubercle bacilli, which had been demonstrated, had disappeared and the general condition of the patients had been greatly improved. It would be very pleasing if these good results could later be classed as having been completely cured and we had in tuberculosis of the children, which according to Leedham-Green is the most frequent, a specific medicament in the tuberculin. At the same time, one must not forget that renal tuberculosis in children runs a relatively light course and seldom causes severe symptoms. In our 120 cases, we operated upon only 7 boys. I have not personally seen any brilliant results following the injection of tuberculin in these cases, although it has been used quite extensively. This treatment is undertaken during the most favorable time for operation, and, therefore, time is lost and when at last they must be operated, the conditions are not so favorable and the patient succumbs at times without positive diagnosis by means of the ureteral catheter having been made.

Of more importance to me is the knowledge of whether healing does take place under tuberculin injection, gained by the unhindered examination of a kidney, which after sufficiently long treatment by injection, must needs be extirpated.

Kraemer reports a case of a one-sided renal tuberculosis which was treated seven months with tuberculin, which later, on account of lack of progress was operated upon. The kidney being removed, showed no signs of healing. Instead there was a widely spread fresh tuberculous process with cheesy areas and no anatomical signs of healing. Also, microscopically, even in the tissues, which to the naked eye were very little changed, fresh tubercles were to be seen.

Important to the question of healing renal

tuberculosis by tuberculin, is the later report by Wildholz, who had the opportunity to carefully examine on five occasions tuberculous kidneys after tuberculin treatment. In none of the 31 cases of light or severe form could the patients be cured or even relieved of their local symptoms. It was not noticed that the patients had suffered in any way from the injections. The kidneys, which were extirpated, did not show the slightest favorable reaction to the tuberculin. Wildholz concluded from this negative healing tendency, that the only benefit to be derived from the use of tuberculin in renal tuberculosis, was to fortify the organism against the toxins of the bacteria, rather than to stimulate a local healing process. My own experience comprises 4 cases in which I had the opportunity to thoroughly examine kidneys which were removed after long continued tuberculin treatment. The first case was a 24 year old man, whose treatment by tuberculin was begun immediately after a positive diagnosis of renal tuberculosis had been made. On account of an increase of complaints, a searching cystoscopic examination was undertaken which showed a badly diseased bladder, and ureteral catheterization demonstrated a right-sided renal tuberculosis. As the left kidney seemed normal, the right one was removed. It showed not the slightest trace of beginning resolution but widespread caseous areas throughout the whole kidney, and many tubercle bacilli.

Of more importance is the second case, in which we could follow with the cystoscope the spread of the tuberculous process within the bladder in spite of the tuberculin injection. The patient, a young woman of thirty years, had had two and one-half years before, severe colicky pain in the bladder after urination. For a time this was better but later, on account of severe pain in the right kidney, she came to our clinic, where, in a short time, tuberculin injections were begun. At the same time, cystoscopic examination was made. Careful examination of a 24 hour specimen obtained without the catheter, revealed no tubercle bacilli, while the urine collected from the catheter which was passed into the right ureter, showed many tubercle bacilli. Around the opening of the right ureter, even at the first examination, was a small ulceration, which at the second examination with the cystoscope some weeks later, had spread into the mucous membrane of the bladder. The advised operation was declined and the treatment with tuberculin was continued. Every subsequent cystoscopic examination revealed a further encroachment of the process upon the mucous membrane of the bladder. After one and a half years of tuberculin treatment, with an apparent transient progress followed by a subjective impairment and an objective demonstration that the process had gradually advanced in the mucous membrane, the patient finally consented to a nephrectomy. The patient, who was of good constitution and well nourished, withstood the operation well and recovered from the operation, only to succumb three months later to a general miliary tuberculosis. The removed kidney showed widespread tuberculous foci, a large tuberculous abscess in the upper pole and a badly destroyed and dilated pelvis. Small miliary nodules were easily seen on either pole and tubercle bacilli in great numbers were demonstrated. There was no sign of beginning healing.

The third case was a 22 year old fresh, healthy looking girl, who for a year and a half had had increasing pain upon urination. A urinary examination showed pus and tubercle bacilli. The tuberculin treatment seemed at first to have a very good effect and lessened the subjective symptoms, but later, the pain and difficulty increased to the highest degree. We found by use of the cystoscope, that the areas around the left ureteral opening and a large part of the bladder were destroyed. The right kidney was completely tuberculous but the left one was healthy. On January 9, 1909, a nephrectomy was done upon the badly diseased kidney. It showed many caseous areas and large groups of small miliary nodules. The dilated pelvis was covered with tuberculous nodules, and here also was a point of beginning healing. The patient is now perfectly healthy and she has no more sub-

jective symptoms referable to either bladder or kidney.

Case four is that of a 20 year old girl who, on account of widespread vesicle tuberculosis and severe impairment of the right kidney, submitted to a nephrectomy. Since local treatment after operation failed to relieve the severe vesical disturbance, the injection of tuberculin was begun and continued for a long time. The patient was finally discharged as improved. Later, in the course of a year we instigated two courses of tuberculin treatment, neither of which resulted in improvement. On the contrary, the process in the bladder continued to advance, other organs became infected with tuberculosis and the patient succumbed to tuberculosis of the lungs with involvement of the peritoneum and other kidney. In this case the tuberculin treatment, even after the removal of the primary focus in the kidney, failed to have a favorable influence upon the process within the bladder. According to objective findings in these cases, we see that the tuberculin treatment failed entirely to promote a healing process. It seems, according to my own observations, that a transient improvement almost always follows the beginning of the tuberculin injection, which is later followed by a real impairment.

In two of the cases, after a long continued tuberculin injection, it was necessary to do a nephrectomy, thus enabling a careful examination of the organ to be made. In these cases also, there was no trace of a beginning healing or even of encapsulation. All cases were severe and showed that the tuberculin treatment had absolutely no influence upon them. With the exception of the favorable results of tuberculin treatment reported by Leedham-Green, the anatomic results of which might be challenged, and cases reported by Karo and Pielecke, as clinically improved, being early cases with slight involvement, or the injection of hetolin (Clerc-dandrys) which might be allowed, it should not be forgotten that in no case has it been demonstrated objectively, that healing has followed such treatment, but that many patients who had not been freed from the diseased organs by early operation, gradually succumbed with increasing suffering.

If, after the usually deceptive beginning improvement following tuberculin injection, one can see no further improvement in the other condition, one should not delay the nephrectomy, which is the surest and best treatment. Thereby the advancement of the disease which will take place during the unnecessary waiting is avoided. The earlier we can diagnose renal tuberculosis, and accordingly, the earlier the organ can be removed, the better will be not only the results following the operation, but also the definite results as regards recurrence of the disease.

TUBERCULOSIS OF THE KIDNEY AND URETER[1]

By ARTHUR DEAN BEVAN, M. D., Chicago, Illinois

MR. PRESIDENT and members of the Chicago Gynecological, Urological, and Surgical Societies: I am very glad of the opportunity of taking part in this discussion on the subject of genitourinary tuberculosis. I take it for granted, that before three bodies composed of operating surgeons, such as are here to-night, that it would be best and profitable and wise for each one of us to discuss this subject largely from the standpoint of his own experience.

It is probably unnecessary for me to remind you that the subject of kidney tuberculosis is a comparatively new field. Any one of you can doubtless find in your own library,

[1] Read before the joint meeting of the Chicago Surgical, Chicago Gynecological, and Chicago Urological Societies, February 3, 1911. (See p. 391.)

if you will pick up one of the older works like Ziemssen's Encyclopedia, for instance, that not many years ago the subject of tuberculosis of the kidney was almost an unknown field. Ebstein in Ziemssen's Encyclopedia, written in 1877, describes pretty well, but briefly, the subject of tuberculosis of the kidney, and refers to it rather because of its pathological interest than because of any clinical side to the condition. He refers to it as a condition which is fatal always within a year, and does not mention any operative treatment. In 1885, before the Congress of Surgeons in Germany, Fisher made the statement that any radical operation for kidney tuberculosis was not warranted, and von Volkmann practically took the same view, and said it was doubtful whether any surgical treatment of tuberculosis of the kidney was of value. In 1891 Madelung, six years later than this discussion in the German Congress of Surgeons, was able to collect sixty cases of nephrectomy for tuberculosis of the kidney, with eleven deaths, and as early as 1901 Israel reported thirty cases of nephrectomy from his own clinic for tuberculosis, with but three deaths. Since that time, of course, really an enormous amount of work has been done on the subject of tuberculosis of the kidney and ureter. One can, at a glance, to-day look over the literature of the subject in Hildebrands Jahresbericht, beginning in 1895, the first volume, and ending with last year, some fifteen volumes in all, and find that in 1895 very little work was done, and to-day the literature is becoming more and more voluminous.

I am not prepared, nor have we the time to discuss fully the pathology of the subject. From the clinical side the pathology that is especially interesting is the fact that in kidney tuberculosis we have, although clinically the primary lesion is in this organ, almost invariably a lesion of the kidney which is secondary to some small, obscure lesion, such as a lesion of the cervical glands or bronchial glands, and that from this original tuberculous lesion a hematogenous infection of the kidney has occurred. Of course, in some cases there is already an overshadowing general tuberculosis, and in such an event the kidney tuberculosis is simply an incident. But the cases that interest us from a clinical standpoint are those in which the kidney tuberculosis is essentially primary in the fact that it is the overshadowing gross tuberculous focus in the body although secondary always previous smaller overlooked tuberculous focus. I should like to make this comparison, too, in discussing the pathology, that kidney tuberculosis is very much like hip-joint tuberculosis, not only hematogenous, but almost always at first a unilateral lesion. We have all seen bilateral hip tuberculosis cases, but where we see one we see very many unilateral hip cases, and the same thing is true of kidney tuberculosis. An ascending kidney tuberculosis from the genital tract is probably a very rare thing. Even where we have a primary kidney tuberculosis on one side, and later the other kidney becomes involved, it is probably as a rule a hematogenous involvement, and not an ascending involvement from the bladder which has become infected from the first kidney. The second point in the pathology which must be emphasized is that the tuberculous process is diffused and involves the kidney structure at many points, making resection of a part of the kidney valueless.

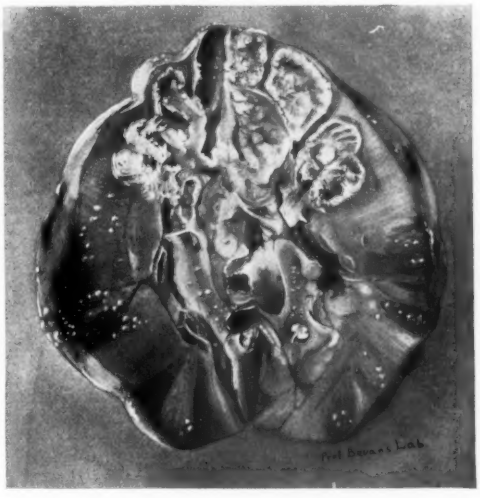
The natural history of the condition is interesting. I should say in ninety per cent of cases the lesion is in its early stage a unilateral affair. This, however, is not borne out by postmortem evidence. In the postmortem evidence we find the majority of cases are bilateral, but that is only to be expected because in the fatal cases there has usually occurred a widespread tuberculous involvement with the other kidney secondarily involved from the hematogenous route. The clinical evidence is quite plain that probably ninety per cent of the cases that come to us early, with definite manifest symptoms, and which can be diagnosed as kidney tuberculosis, are lesions limited to one side, beginning in the kidney, secondarily involving the ureter, extending from the ureter to the bladder mucosa. The natural history uninterfered with by treatment is usually a fatal termination with general tuberculosis.

Some of these cases, however, go on to a spontaneous recovery, and not infrequently in the deadhouse cases of kidney tuberculosis are found in which the kidney has been changed to a caseous mass, surrounded by dense fibrous membrane, showing definitely a cure of kidney tuberculosis in that particular individual, not by a cure of the lesion in the kidney first involved, but a cure because that kidney has been entirely destroyed and encapsulated and because of its total destruction a pathologic nephrectomy there has been cessation of the symptoms. Cabót, of Boston, who was here in Chicago the other day, at a meeting of urologists, challenged any one to produce evidence of a case of healed kidney tuberculosis. I have not the evidence here to-night, but I have no doubt that cases of kidney tuberculosis go on to recovery just as cases of lung tuberculosis go on to recovery, but not nearly as often as in tuberculosis of the lungs, and definite cases of this kind can be found in the literature. I know from my own limited experience of three or four cases of kidney tuberculosis which have gone on to a recovery, so that we must accept the statement that these cases are quite capable of going on to a recovery just as are cases of tuberculosis of other organs and of other tissues. Admitting that many of these cases which recover may be cases in which the kidney has been totally destroyed, there are I believe others where the lesions heal without destroying the kidney. What do we find in these cases as they come to us as patients? Frequency of micturition is the principal symptom that these patients will complain of in the early history of the disease. There is a little pus in the urine. In twenty-five or thirty per cent of the cases there is blood in the urine sufficient to dignify it by the term hematuria. Pain, and pain that is rather characteristic in many cases, along Poupart's ligament in the flank, an aching sensation, sometimes fairly painful; a sense of uneasiness or pain in the back, and occasionally with plugging of the ureter with blood or debris, a distinct renal colic. Many of these cases are patients in very fair condition early in their history. Later, however, the evidence of a tuberculous process is shown by a loss of weight, evening temperature, weakness, and so forth. A tumor is rather one of the late evidences of the lesion, and frequently means a perinephritic process or compensatory hypertrophy of one kidney following total destruction of the other. In this connection I want to warn you against removing a large tuberculous kidney without absolute knowledge that there is a normal kidney on the other side, as a large tuberculous kidney with a good deal of kidney tissue remaining usually means compensatory hypertrophy and destruction of the other kidney first involved.

The differential diagnosis is one of the most interesting problems that confronts us in this work, and it must be made from an infection of the kidney from other causes, as a pyelitis from colon or other pus organisms, from such rather rare lesions as congenital cystic kidney, essential hematuria, but especially must it be differentiated from stone and from neoplasm of the kidney itself. As a rule, this is simple and can be decided by a careful study of the urine microscopically and chemically to determine the presence of tubercle bacilli and the use of the X-ray. I think one can say in the majority of cases in kidney tuberculosis to-day that by careful examination, repeated, the bacilli of tuberculosis can be found. Of course, when this is determined it makes the diagnosis very definite of a tuberculous lesion, at least, of the urinary tract. Stone is eliminated by the X-ray; neoplasm with more difficulty. In a neoplasm you have a hematuria, very frequently pain, sometimes a swelling. If with such a picture of neoplasm you have no evidence of tubercle bacilli and the X-ray is negative, one should rather accept the probable diagnosis of neoplasm. Cystoscopic examination is very important. Willy Meyer's description of how a kidney tuberculosis stamps the area around the ureter on that side like the foot prints in the snow is very graphic. It does in almost all cases show its presence pretty definitely by little ulceration and tubercles on the infected side, with a golf hole appearance of the ureter opening. It is very important in kidney tuberculosis to determine whether we have

one or both kidneys involved, and I am rather inclined to believe we cannot trust to the segregator, that we must accept the evidence of the cystoscope, and especially the evidence obtained by examining the catheterized urines from the right and left sides obtained with the ureteral catheter.

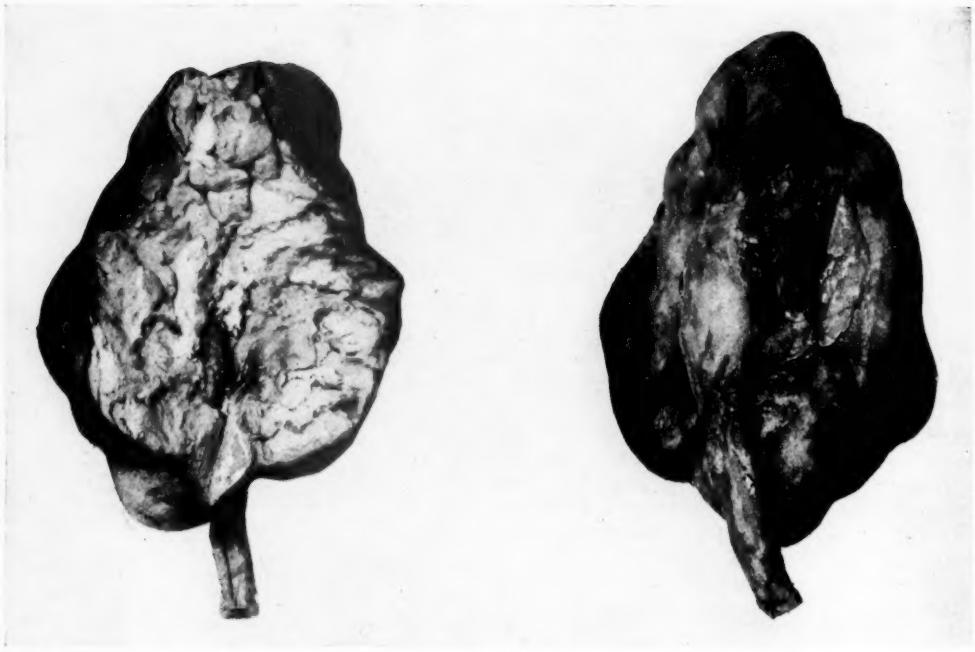
Where we can demonstrate to-day in our clinic a definite unilateral tuberculous lesion of the kidney, without any gross or evident tuberculous lesion elsewhere in the individual, if the patient is a fair surgical risk, we urge an early nephrectomy. I think the treatment of kidney tuberculosis might be well discussed under two heads, medical management and the surgical treatment. I think the medical management is very important. I think that here, as in any case of surgical tuberculosis, medical management means very much. For instance, let us take tuberculosis of the epididymis. I should say without hesitation that the medical management means more than any surgical treatment that to-day can be carried out in any particular case. In kidney tuberculosis I should not go that far, but the medical management means very much, and the patient must be given at the outset the same hygienic management that is given to cases of tuberculosis



Caseating tuberculosis of the kidney.

Caseating tuberculosis of the kidney.

of the lungs. Whether the use of tuberculin by the Wright method in minute doses is of value or not is to my mind still a question. I have known three or four cases to recover under the use of tuberculin, either controlled by the use of the opsonic index or without it. Professor Hektoen of this city has studied this subject with a great deal of interest and has carried out this treatment in several cases, some of them exceedingly successful, combined, always, however, with the best hygienic management of the cases. I must admit, however, that alongside of these cases that have recovered under medical management and tuberculin, I know quite as many that have recovered without tuberculin, under medical management alone, and I should like to emphasize as much as anything that I will have to say to-night that some cases of kidney tuberculosis can be cured without operation. I think that is a hopeful fact, because not infrequently these cases are bilateral, and it is clearly to my mind the duty of the surgeon in a case of bilateral tuberculosis to use the medical management and to experiment at



Tuberculosis of left kidney and ascending infection of the right kidney.

least with tuberculin rather than attempt any surgical intervention unless this is absolutely called for to meet some special indication.

As to the surgical treatment, the technique is as a rule simple in the early cases before there is any perinephritic process. After determining that we have to deal with a case of tuberculosis limited to one kidney, and that the patient has another functionating kidney, and the gross urine output in twenty-four hours indicates kidney sufficiency, I think we should proceed to the operation. We make the usual oblique kidney incision, obtain a wide exposure of the kidney. I have no sympathy with resection of the twelfth rib. I have never seen a case of tuberculosis or neoplasm of the kidney in which resection of the twelfth and eleventh ribs was necessary to obtain wide enough exposure to do a nephrectomy. Before there is a perinephritic process there is no difficulty, simple separation of the kidney from its fatty capsule, bringing it out into the wound, if possible, ligating the vessels, and the ureter separately. This is not always possible. In a number of cases we have such a mass of tuberculous tissue about the ureter that we are compelled to ligate both vessels and ureter *en masse*. Wherever possible, the vessels should be ligated separately and the ureter brought out at the angle of the wound. It is not good surgery to attempt to remove the entire ureter. The evidence on this point is fairly conclusive, that it is not absolutely essential to remove the ureter; that tuberculosis of the ureteral mucosa clears up after the removal of the primary focus, just as a lesion of the bladder mucosa clears up. I inject the ureter with carbolic acid, or stitch the ureter to the skin wound and inject it with alcohol. I am inclined to think I shall adopt the latter method as a routine and give it a good trial. I stitch the ureter in the line of incision, inject it with alcohol, and, if necessary, repeat the injections, and not sink

Right kidney.

the tuberculous ureter in the soft tissues. If any of you will examine the ureter at the time of operation you will find as a rule that the tuberculosis is limited to the interior of the ureter, and if at the time of operation the ureter is left buried in the tissue, you will find later tuberculous infection of the wound. In cases where we have a perinephritic process to deal with, I am rather inclined to believe it is wise not to attempt to remove the capsule, but to split the fibrous capsule and remove the tuberculous kidney from within the fibrous capsule. I certainly have lost two patients in cases where we had attempted in tuberculous kidney to remove not only the kidney but the entire capsule in a case of old perinephritic process after a previous nephrotomy had been done. In these cases it is much simpler to split the fibrous capsule and remove the kidney tissue within the fibrous capsule. Ligation of the vessels is somewhat difficult, but if it is extremely difficult the vessels can be clamped and the clamp left on twenty-four hours within the fibrous capsule. In those cases we have unquestionably some tuberculous lesion left, and the wound should be packed with iodoform gauze and handled in a manner very similar to that in which those cases of tuberculosis of glands of the neck are handled where curettement has been resorted to.

As to nephrotomy and resection, resection certainly has no place in the discussion of kidney tuberculosis. I have tried several of these resections. Resection has been given a fair trial. Any one who will examine half a dozen specimens of tuberculous kidneys such as I have passed around to-night, must be convinced that in practically every case, after a portion of the kidney was removed the rest of the kidney would still contain tuberculous tissue. Nephrotomy I have found to be an exceedingly unsatisfactory operation. I have made nephrotomies in a number of cases because I felt the patient was in such a bad condition as not to stand a nephrectomy. I think I have seldom accomplished much by nephrotomy in cases of tuberculosis of the kidney. Practically all these cases required later nephrectomy, and the secondary

Unilateral tuberculosis of the kidney.

Tuberculosis of the ureter.

nephrectomies are usually made with exceeding difficulty. The adhesions about the kidney are such as to make it essential to remove the kidney tissue from within the fibrous capsule.

As to the prognosis, I think it would be safe to say that the operative mortality in the early cases should not exceed ten per cent. In my own statistics the primary mortality has been less than this.

As to the end results in these cases, I think it would be fair to say that the majority of these patients are permanently cured; that probably in the neighborhood of forty or fifty per cent the cases eventually succumb to tuberculosis either extending from the primary kidney focus or from a general tuberculous process. It is interesting to follow the picture of an early and moderate infection of the bladder in these cases. Almost all of these go on to recovery within three to six months or a year, not all, however, by any means. Some of the cases of infection of the bladder continue, and in spite of removal of the primary focus the patients succumb to tuberculosis later.

I think, Mr. President, that this covers about the ground of the subject as it has developed in my own clinical work.

GONOCOCCAL INFECTIONS OF THE KIDNEY

Report of Two Cases

By P. IRELAND NIXON, M. D., Baltimore, Maryland
Resident House Officer, Johns Hopkins Hospital

THE old idea that gonorrhœa is a purely local disease, which may run an acute course or which may become chronic, has given place to the recognition that in addition to the local lesions there may arise general manifestations or regional manifestations in other parts of the body which often outstrip in severity the original disease. A review of the literature shows that practically no organ or tissue in the body can claim immunity to invasion by the gonococcus; generalized infections, arthritis, endocarditis, conjunctivitis, pleurisy, meningitis, neuritis, proctitis, phlebitis, peritonitis, subcutaneous abscesses, myositis, inflammation of bone and skin, and other more rare conditions, have been proven to be of gonococcal origin. A consideration of these is far beyond the scope of this paper; it is my purpose here to consider gonococcal infections of the kidney.

From the anterior urethra, the usual portal of entry for the gonococcus, the infection spreads backwards to the posterior urethra in the majority of cases, the periurethral tissues being involved to a greater or lesser extent. In men the prostate may be invaded and may furnish by its peculiar anatomy a place suitable for the long-continued development of the organism; or vesiculitis, epididymitis and cystitis may be the result of further extension of the process. Just how frequent gonococcal cystitis is has not been well established. Certainly in women it is not at all rare. Even at the stage when cystoscopic examination is justifiable, one quite often sees congestion of the trigonum and in some cases slight congestion of the whole bladder, with scattered areas of superficial ulceration; gonococci can easily be demonstrated in the urine from such a bladder. Cystitis in the male is less frequent than in the female, the difference doubtless being due to the difference in anatomical conditions.

Considering the frequency of gonorrhœa and the frequency of non-gonococcal infections of the kidneys, it is surprising that the gonococcus plays such an insignificant rôle in kidney diseases. My impression, gained from a survey of reported cases, is that gonococcal infections of the kidney are quite infrequent, despite the opinion of others to the contrary. Cumston (1), writing in 1899, was of the opinion that the condition is more frequent than the number of reported cases would signify, the reason being that "symptoms of the renal lesions develop in a latent way, and only of limited intensity, a spontaneous recovery taking place." A large number of cases are on record in which symptoms referable to the kidney have developed during the course of an acute or chronic urethritis of Neisser origin, and the tendency has been to hold the gonococcus responsible for the renal symptoms. That such a conclusion may be fallacious is well shown by a case reported by Marcuse (2). A patient with urethritis developed symptoms of pyelitis; tubercle bacilli were demonstrated in the urine and a guinea pig was injected with positive results. Likewise in three similar cases reported by Sellei and Unterberg (3) the colon bacillus was proven to be the causative agent. My impression, then, is that the condition under discussion is not common; the actual demonstration of gonococci in the kidney or in the urine or pus from the kidney by ureteral catheterization or at operation is the only reliable method, and this has not been done very often. Finger's (4) opinion that "the diagnosis of blennorrhagic pyelitis is made not infrequently but usually improperly," is as true to-day as it was in 1894. A history of gonorrhœa, the development of renal symptoms during gonorrhœa, and the chemical examination of the urine, however important they may be, are not sufficient to justify a diagnosis of gonococcal pyelitis or pyelonephritis.

MODES OF INFECTION

The relation between cystitis and inflammatory conditions of the kidney is a very interesting one and at times is not at all clear. The presence of one does not necessarily indicate the presence of the other: a patient may have a suppurative pyelonephritis in one kidney without any evidences, subjectively or objectively, of a coexisting cystitis; or the bladder may be inflamed without causing infection of, or symptoms referable to, the kidneys. The consideration of the modes of infection by the gonococcus will involve the discussion of the same conditions that are called forth by infection by other organisms. There are two modes of infection, ascending and descending.

A. *Ascending infection.* Under ordinary conditions the upper urinary tract is unfavorable soil for the growth of bacteria; it is protected by the sphincter action of the bladder on the ureter as it passes through the bladder wall, it is everywhere paved with a thick layer of epithelium and is continually being irrigated by a descending flow of urine. Urinary obstruction and infection together with local or general lowering of resistance produce conditions favorable for ascending infection. Sampson (5), in a series of dogs, tied one ureter and injected 2 cc. of a 24-hour bouillon culture of staphylococcus aureus into the jugular vein; in every instance the kidney whose ureter was ligated, as a *locus minoris resistentiæ*, became infected. Here is an experimental proof of the frequent observation that urinary obstruction and infection favor the development of renal inflammation.

There are four possible routes for an infection to travel from the bladder to the kidney:

1. Through the vesico-utero-ovario-renal circulation. Sampson (loc. cit.) demonstrated by injection methods that a definite communication between the branches of this series of blood-vessels does exist.

2. By continuity along the mucosa of the ureter. Just how important this route is is not clear; under normal conditions it would seem to be of but slight importance. However, injury to the ureteral orifice or obstruction to the ureter, causing stagnation of urine and interference with the function of the kidney and ureter, may allow infection to extend along the ureteral mucosa.

3. Through the blood-vessels of the ureter. That infection can pass from the bladder along the ureteral blood-vessels to the kidney is quite probable. Sampson showed that there is a free communication between the blood-vessels throughout the whole length of the ureter by injecting colored gelatine into the renal artery and by finding that the injected material made its way to the ureteral orifice in the bladder.

4. Through the lymphatics. This is probably the most important route of ascending infection. Sakata (6) using injection methods in infant cadavers concluded that there is a communication between the lymphatics of the bladder and kidneys but that it is not direct; he thinks that regional glands in the kidney or bladder and ureteral lymph vessels intervene as relay stations. Sampson's experiments of leaving lampblack and bacteria in the bladder failed to confirm Sakata's conclusion. The observations of Kumita (7) show that there is close communication between the lymphatics of the ureter and the perinephric tissues and are verified by some recent work by Stewart (8). The latter transplanted the ureters into the large or small bowel of dogs and in several cases caused infection of the tissues surrounding the kidney, with entire absence of renal changes. This relation together with the early production of cortical abscesses without involvement of the medulla or pelvis, would suggest that some of the inflammatory processes in the kidney are preceded by similar processes in the perinephric tissues.

It is claimed by some writers that the gonococcus can reach the kidney by ascending infection without causing a demonstrable lesion in the bladder; Dowd (9) reports having observed instances in which he found the bladder uninvolved, " the cystoscope showing only one or two reddish streaks, apparently under the mucous membrane, extending from the urethral to the ureteral openings "; but unfortunately he cites no cases in defense of his statement. On the contrary, Sellei and Unterberg (loc. cit.) have never seen a case

of gonococcal pyelitis without an antecedent or concomitant cystitis. This difference of opinion may be explained on one of two grounds: absence of visible bladder lesions is not in itself an argument that the infection is not ascending, for there may have been a multiplication of organisms in the bladder urine, especially if there is residual, without implicating the bladder mucosa; or cystitis may have been present and disappeared before the patient was seen. Brown (10) has seen several cases of primary bladder involvement in which the cystitis symptoms became much less severe after the pyelitis had become established, so that the bladder appeared practically normal on cystoscopic examination.

B. *Descending or hematogenous infection.* It is well established that the gonococcus can, alone or associated with other bacteria, cause inflammatory changes in parts of the body distant from the urethra, and in all probability it is transported by the blood stream since the organism has been recovered in pure culture from the blood in a number of cases. Gonococci in the circulating blood may lodge in the kidney and there initiate changes that would favor the invasion of other bacteria; in fact, it is generally believed that the gonococcus prepares the soil for the growth of secondary invaders. When we consider that, under conditions where the output of urine is great, 5 or 6 per cent of the total quantity of blood sent out by the heart in a minute may pass through the kidneys (11), it is not easily understood why the kidney is not involved in a correspondingly large number of cases; it may well be that the gonococci do lodge here but find conditions adverse to their development; it is conceivable that in association with its function of elimination, the kidney possesses certain bactericidal properties that are less well-developed in the other organs. Of the 29 cases of general infection collected by Cole (12) in 1908, not one of them showed any active involvement of the kidney, although six of them had abscess formation in other parts of the body. In this connection it is to be remembered that the presence of bacteria in the kidney urine does not necessarily mean kidney infection: there is a bacteriuria in many infectious diseases, notably typhoid fever, where 25 per cent of the cases have typhoid bacilli in the urine; Geraghty (13) and others have reported cases of persistent bacteriuria of renal origin where there were practically no symptoms; and Dudgeon (14) in 3 out of 20 cases of chronic constipation and in 9 out of 45 pregnant or puerperal women demonstrated the colon bacillus in the urine, all the cases having no symptoms whatever from the urinary tract. Bacteria may thus be eliminated in the urine without leaving any demonstrable evidence of their passage through the kidney.

It is not determined which of the two modes of infection is the more important as regards the gonococcus. In non-gonococcal kidney infections there is a great preponderance of female cases and about two-thirds of these are due to the colon bacillus. It is thought that ascending infection is the more important in the latter group of cases; the short female urethra, being in close proximity to the vagina and rectum, affords conditions favorable to the entrance of the motile colon bacillus into the bladder. It is interesting to note in this connection that of the 10 collected cases—excluding those cases that are part of a general infection and hence obviously metastatic—8 were men; the prevalence of gonorrhœa in men may explain the difference. It is well known that gonococcal septicemia is more frequent in men, the difference being due doubtless to the long male urethra with its diverticula which favor the multiplication and absorption of the organisms. This fact taken with the reversed relation mentioned above would suggest that in men hematogenous infection of the kidney with the gonococcus is more frequent than ascending infection, although it is impossible to draw any definite conclusions from such a small number of cases.

REPORTS OF COLLECTED CASES

The collected cases will be presented in four groups:

I. Cases not proven.

II. Cases associated with general septicemia.

a. Gonococcus alone.

b. Mixed infection.

Fig. 1. Case 2. (Slightly reduced.) Kidney has been split longitudinally and opened out, exposing both anterior and posterior surfaces. The contrast between the upper and lower poles is well shown. Several indentations are seen in the upper pole.

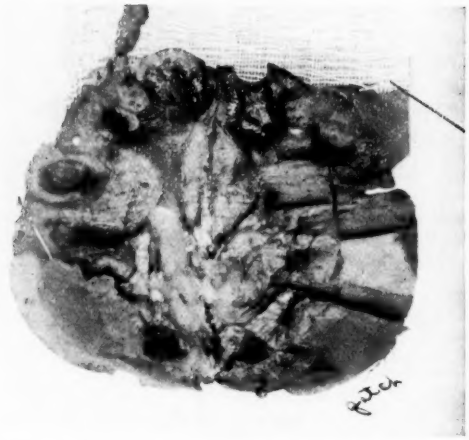


Fig. 2. Photograph of cut section of kidney from the same case. Abscess cavities opening into the pelvis at the upper pole and hypertrophied parenchyma at the lower pole are visible. White patches are seen in the pelvis.

III. Pyelitis.
   a. Gonococcus alone.
   b. Mixed infection.
IV. Pyelonephritis.

I. CASES NOT PROVEN

A large majority of the cases appearing in the literature belong in this group. Many of the reports are not convincing enough to be worthy of mention. Here are included the cases that were diagnosed on symptoms or chemical examination of the urine and those cases where the bacteriological examination was not sufficient to justify the diagnosis. Some of the earlier cases are mentioned more for historical interest than otherwise.

Bockhart (15), in 1883 inoculated the urethra of a paralytic dement forty-six years old with gonococci. Death followed ten days later. At autopsy abscesses were found in the right kidney which he thought were due to the gonococcus. But it has been shown that he was not dealing with the gonococcus at all (16). Israel in 1889 and Fürbinger (17) in 1890 report several cases that were diagnosed on symptoms: chills, fever, polyuria, pain in the renal region during gonorrhœa. From Balzer and Souplet (18) we hear the first of the method of differentiating gonococcal pyelitis from cystitis by the presence of albumin in the urine in amounts greater than could be accounted for by the pus cells. It is a little surprising that as late as 1909 cases are reported in which this method of differentiation was used. It is true that albuminuria frequently occurs during the course of gonorrhœa, but as Lewek (27) has shown from a study of 155 cases, it is usually associated with blood and pus and has no significance as to the presence of a renal lesion; in the few cases where the amount of albumin is too large to be accounted for in this way, the excess may be due to fever or to renal irritation from certain drugs. Neuendorff (19) in 1892 observed a case which developed renal symptoms eight weeks after the onset of urethritis without any bladder symptoms; gonococci were found in the bladder urine only.

In the urine of Kelly's (20) case of pyonephrosis, organisms were found that were thought to be gonococci, but no cultures were taken and no differential stains made. The cases of Mendelsohn (21) and Schmidt (22) were diagnosed on symptoms. Rosenfeld (23) relied on the excess of albumin, the irreg-

ularity of the pus cells and the degeneration of the red blood cells present in the urine in making his diagnosis. Berg's case (24) had symptoms of arthritis and endocarditis before death. At autopsy the kidneys were but little changed macroscopically; there was a small amount of turbid fluid in the left kidney pelvis, and in this were seen a few Gram-negative diplococci " which were considered to be gonococci." There was no involvement of the bladder, so that if there were a gonococcal infection of the kidney, it was in all probability metastatic or part of a general infection. Cumston (1) thinks a pyonephrosis that developed three weeks after the onset of an acute urethritis was caused by the gonococcus. At operation about a liter of pus was evacuated. Cultures taken from the pus were negative for any organisms, as were also stained smears; but this, he thinks, " can be explained from the fact that fever will cause the gonococci to perish after they have produced their havoc in the form of a suppurating process." Several of the authenticated cases cited below will negative this opinion.

Young (25) considered his the first proven case of gonococcal kidney. The patient had had repeated attacks of gonorrhœa, the last of which was five years before applying for treatment. Since this attack cystitis symptoms had been present; for a year the patient had had attacks of pain in both kidney regions, associated with chills, fever, and sweating. Both kidneys were enlarged and tender. The bladder was aspirated suprapubically; gram-negative diplococci were demonstrated in smears and culture. Young argues that if any organism other than the gonococcus had been the cause of the renal symptoms it would have been present in the bladder urine.

Cabot (26) reports the case of a young man with an antecedent history of urethritis six years before, who was complaining of occasional attacks of pain in the right kidney region. On cystoscopic examination the bladder was normal; pus was seen coming from the right ureter in which were found "many gonococci"; no cultures were taken and the method of staining was not given. At operation a pyonephrosis and six kidney stones were found. Staphylococci but no gonococci were demonstrated in the pus.

Neither of Ravogli's cases (28) is entitled to acceptance. Both of them, four or five weeks after a urethritis, developed pain in the lumbar region, "irradiating towards the abdominal side," nausea, vomiting, fever, and pains in the joints. Both had casts in the urine; in some of the cases bacteria were seen, many of which were gonococci. Cultures were apparently not made and the urine was not collected directly from the kidney.

Denis (29) treated a woman who for five weeks had been complaining of pain in the left lumbar region; there was a history of vaginal discharge and bladder symptoms three years previously. A tender tumor mass was made out in the left flank. The urine was purulent and contained diplococci, some of which resembled gonococci; no differential stain mentioned and no cultures made. On cystoscopic examination blackish patches (sclerose vesicale) were made out, especially in the region of the left ureteral orifice, from which pus was seen to come on exerting pressure on the tumor in the left flank; the ureter was not catheterized.

Stoyantchoff (30) in a recent article makes many very general remarks on the renal complications of acute gonorrhœa. He reports no illustrative cases but says he has had several. The presence of albumin in the filtered urine, gastric disturbances and a coated tongue in the course of acute gonorrhœa, are in his opinion sufficient to make the diagnosis. The criticism that was made of some of the earlier cases is applicable here; indeed, it would seem that his evidence does not warrant his first conclusion: " Acute gonorrhœa may attack the kidney."

II. CASES ASSOCIATED WITH GENERAL SEPTICEMIA

Belonging to this group I have found three cases. Most cases of general infection with the gonococcus have shown simply a parenchymatous degeneration of the kidney. Tyree (31) thinks that a glomerulonephritis accompanied by leucocytes in the tubules is probably more characteristic than parenchymatous

degeneration. Cases of general septicemia following a gonorrhœal conjunctivitis have been reported, Brehmer (32), Höck (33), but in none of them was the kidney involved.

a. Gonococcus alone, 1 case.

Asahara (34) in 1898 reported a case of a servant girl sixteen years old who was admitted in an unconscious condition. It was learned that the onset was three days before, with pain in the right leg, headache, pain in the abdomen, and vomiting. On admission the temperature was 104.7°; spleen palpable; petechial spots over abdomen and thighs; hymen ruptured; vagina reddened; no gonococci in discharge. Diagnosis of peritonitis, appendicitis, and sepsis was made. Patient died three days after admission. At autopsy there was a fibrinous pleurisy, many small abscesses in the lungs and cloudy swelling of all the organs; in the kidneys were seen several "poppy-seed-sized" areas, yellowish gray and slightly raised above the surface; no pus was present in the kidney. Gonococci were demonstrated in smears from the kidney and in the stained sections of the kidney and lung tissue. Cultures on ordinary media remained sterile. This is the only case in the literature where active involvement of the kidney parenchyma has been proven to be due to the gonococcus alone.

b. Mixed infection, 2 cases.

Asahara in the same communication reported a case of a man forty years old who was complaining of pain in the neck. Onset seven days before admission after patient caught cold. Abscess of neck and pleurisy made out on examination. Patient died one week later. Autopsy showed a large cervical abscess, left-sided pleurisy with effusion, several small abscesses in the left kidney, and a urethritis. Gonococci were found in the urethral discharge; gonococci, bacilli, and other cocci in the cervical and renal abscesses. No cultures were made.

Wynn's case (35), a man aged nineteen, had had a cough and pain in the back for a week. He was delirious on admission. Death one week later. Autopsy: chronic urethritis, miliary abscesses in right kidney and lungs, small abscesses in prostate. Gonococci, bacilli, and staphylococci found in the urethra, prostate, kidney, and lungs. Cultures showed the presence of the colon bacillus and staphylococcus albus in all these organs; a good growth of the gonococcus was obtained from the prostate; only a feeble growth from the kidney.

III. CASES OF PYELITIS

Most of the authenticated cases fall under this heading. It is notable that the pure gonococcal pyelitis cases predominate.

a. Gonococcus alone, 6 cases.

Marcuse (36) in 1902 reported two cases from Casper's clinic. Case 1. Male, aged twenty-five, had had gonorrhœa two years before and again three months before; complaining of pain in right side. Patient was cystoscoped and the right ureter catheretized; cloudy urine containing pus and typical intracellular diplococci was obtained; no other organisms were present. There was a hydronephrosis of 100 cc. Lavage of the renal pelvis was done once a week; after two recurrences the condition cleared up.

Case 2. Male, aged twenty-two. Ten days after onset of urethritis patient complained of fever, pain in both kidney regions, and frequent urination. The symptoms improved but did not disappear after bladder irrigations. Cystoscopy ten weeks later: purulent urine from right side containing many intracellular diplococci; clear urine from left side. The condition was cured by irrigating the kidney pelvis with silver nitrate solution.

Dodge's case (37) has not received proper notice, probably because it was published under a misleading heading. He treated a woman who, three weeks after marriage, developed cystitis symptoms. Patient's husband had had a mild attack of gonorrhœa a short time before marriage. The bladder condition improved under ordinary treatment, but a small amount of pus persisted in the urine. On catheterizing the left ureter purulent urine was obtained and in it gonococci were demonstrated on several occasions. The pelvis was irrigated with boracic acid solution and a dram of 25 per cent argyrol solution instilled. There were no symptoms after the first irrigation. Gonococci disappeared after the third treatment.

One of the cases reported by Bransford Lewis (38) is unique. A man, aged twenty-four, had had repeated attacks of urethritis for six years, which proved rebellious to the usual form of treatment. Infection of the upper urinary tract was suspected. Cystoscopic examination: three ureteral orifices were seen, two on the left side and one on the right. All were catheterized; clear urine from right ureter, clear urine from one of the left ureters, cloudy urine from the other, containing pus cells and diplococci which decolorized by Gram. The organisms disappeared after one injection of a silver solution, and the patient had no more recurrences of urethritis. Lewis thinks these recurrences were due to reinfection from the upper urinary tract.

Sellei and Unterberg (3) report one case of pure gonococcal pyelitis. A man had been ill for ten months with symptoms of urethritis, prostatitis, and cystitis. These improved but did not yield altogether to treatment. Slight pain developed in the right kidney region, and pyelitis was suspected. No chills nor high fever were present. Cystoscopic examination: the vessels of the bladder were much injected; marked hyperemia of right ureteral orifice. Urine from the right kidney was cloudy and contained pus cells, mostly mononuclears, and a pure culture of gonococcus was grown from it. Result: cured by pelvic lavage.

Hagner (39) has recently reported an undoubted

case. A man, aged thirty-five, gave a history of gonorrhœa ten years before, and again six weeks before seeking advice. Five days before he was seen he developed pain in the right inguinal region along the right ureter. No chills. No nausea. Temperature ranged from 99° to 100°. Urethritis and prostatitis were present; these cleared up after six weeks' treatment, but pyuria persisted. Cystoscopic examination: bladder normal except for some reddening of trigonum, especially in the region of the right ureter. Pus was seen to come from the right ureter. Ureter catheterized, and a diplococcus was recovered from the urine which corresponded culturally and morphologically to the gonococcus. Radiograph of the argyrol distended pelvis showed it to be normal in size. Lavage of the kidney pelvis with 1 per cent silver nitrate solution and vaccine therapy effected a cure.

b. Mixed infection, 1 case.

Sellei and Unterberg (loc. cit,) observed a patient who for three months had had urethritis and cystitis. Later he complained of some pain in the right kidney region, where on pressure there was slight tenderness. No chills nor high fever. Urethritis yielded to treatment; cystitis persisted. Cystoscopic examination: bladder mucosa somewhat injected; right ureter catheterized and cloudy urine obtained; many pus cells, mostly mononuclears, in urine. The gonococcus and colon bacillus grew on culture.

IV. PYELONEPHRITIS. 3 CASES

In this group are included all cases in which there was actual pus formation, although the third case might more properly be considered a kidney abscess. Of the three cases, two came to autopsy. In all probability all were mixed infections.

Gerster (40) saw a boy of ten years in whom pain in the loins, nausea, and vomiting developed three weeks after the onset of an acute Neisser urethritis. On examination both kidneys were enlarged and tender. Right nephrotomy was performed under chloroform; the kidney was greatly enlarged. On incising the cortex a "dark brown, fetid, decomposed serum oozed out." The patient's condition would not justify exploration of the left kidney. Death followed twenty hours later. Autopsy: both kidneys enlarged; one small abscess in the left kidney; large number of abscesses in the right kidney; bladder mucosa hæmorrhagic; small abscess in the prostate. Cover glass preparations and cultures demonstrated the presence of the gonococcus and staphylococcus albus.

Bransford Lewis (41) in 1900 reported a case of a man fifty-four years old, who was admitted in a semiconscious condition; the case was not studied closely clinically for this reason. It was learned that he denied having had gonorrhœa. Twelve years before admission he first noticed a dull pain in the kidney regions associated with the passage of small amounts of urine at frequent intervals; since that time there had been sediment in the urine continually. Of late years there had been increasing lassitude, headache, vertigo, failing vision, dyspnœa, and loss of weight. The patient died soon after admission to the hospital. Autopsy: tuberculous cavities at the apex of each lung; right kidney enlarged to twice the normal size; on cut section numerous abscess cavities about the size of a walnut were seen in the kidney; the ureter was greatly dilated and thickened. A. Gram-negative diplococcus was demonstrated in smears and in cultures.

The question arises whether the gonococcus can be held accountable for the condition of this kidney. The presence of tuberculous cavities in the lungs taken with the history obtained would surely make tuberculosis of the kidney a possibility as the primary lesion, the gonococcus being the terminal or secondary invader. In the history of the case no mention is made of a search for tubercle bacilli in the pus.

Weisswange's case (42) is unique in that the condition developed during the puerperium. A woman aged thirty-four, gave a history of gonorrhœa seven years previously; she had eclampsia at the time of her first confinement several years before. On admission seven days after labor she had a temperature of 103° and complained of severe headache and pain in right side. The right kidney was much enlarged and tender. Bladder urine was cloudy and gonococci were demonstrated in it. Patient improved under medical treatment so that she was able to go home. She came back two months later with a return of former symptoms. Cystoscopic examination: bladder practically normal; clear urine from left side, cloudy from right; pus and gonococci were present in the urine from the right kidney. At operation a large abscess was found in the upper pole of the right kidney. The remainder of the kidney was apparently normal as revealed by nephrotomy. Stained preparations of the pus showed the presence of gonococci. No mention is made of cultures, so that there is no proof of the absence of a mixed infection.

There are, then, thirteen reported cases of gonococcus infections of the kidney, seven pure and six mixed. Ten of the thirteen cases were men. The right kidney was involved eight times, the left three times, both kidneys twice. As to the time of development and duration of the symptoms there is great variation. In the cases of pyelitis the renal manifestations usually asserted themselves between the sixth and the twelfth weeks; in one

case they appeared as early as the tenth day, and in another as late as the tenth month. After the diagnosis was made and proper treatment instituted, the symptoms invariably cleared up within a short time. As to pyelonephritis, the cases are too few and the time of appearance too varied to warrant any definite conclusions; with the exception of Gerster's case, the disease ran a chronic course. Of the three cases of general infection with involvement of the kidney, all died. Internal measures or pelvic lavage effected a cure in all of the pyelitis cases. Two of the three cases of pyelonephritis came to autopsy; the third was relieved by nephrotomy and drainage.

AUTHOR'S CASES

To these collected cases I wish to add two others. I am under obligations to Dr. E. K. Cullen, in whose service the patient was admitted, for the privilege of reporting the second case. Dr. G. L. Hunner has very kindly put the bacteriological notes of the first case at my disposal.

CASE 1. L. C., female, white, aged twenty-two years, single; admitted to the Gynecological Department of the Johns Hopkins Hospital July 13, 1899.

Complaint. "Backache, sideache and bad-looking urine."

Family history, negative.

Personal history. General health fair. "Typhoid pneumonia" at thirteen years of age. Chills and fever every fall for five years. Menstrual history normal except for amenorrhœa for the past four months. Considerable leucorrhœal discharge lately.

Present illness. Patient has not been well for four years, although she has had no definite complaint until four months ago, when she began to have backache and pain in the left side and down the thighs. These symptoms have persisted. At the present time there is a constant desire to urinate during the day; patient has to get up three or four times at night. No pain or burning on urination. Urine has been cloudy at times. Patient has lost about ten pounds in weight in the last two months and there has been an increasing feeling of general weakness. During the past few months patient has had what she calls good days and bad days; perhaps for several days at a time she would feel well and the urine would be clear; then pain in the side would appear and the urine become cloudy and urination frequent.

Physical examination. Patient is an undernourished young woman. Mucous membranes rather pale. Heart and lungs negative. Abdomen: there is slight fullness in the left lumbar region, where on palpation an indefinite mass can be felt. The mass feels firm and is very tender. Pelvic examination negative, except that there is a urethral discharge; in smears from this were seen many typical biscuit-shaped, Gram-negative diplococci. Pulse 90, temperature 98° to 103°.

Urine cloudy, acid reaction, specific gravity 1020; many pus cells microscopically.

Cystoscopic examination. Bladder everywhere normal except for slight reddening about the left ureteral orifice. From the left ureter hangs a large drop of creamy pus which drops to the speculum and is succeeded by others. Urine from the right kidney clear. Attempt to catheterize the left ureter demonstrated an obstruction about 2 cm. from the ureteral orifice. No tubercle bacilli found in the urine.

Operation. Nephrotomy and drainage. About 150 cc. of thick, creamy, non-offensive pus was evacuated from an abscess cavity in the kidney substance. On examining the pus a few biscuit-shaped cocci were found. Plate cultures were made on equal parts of agar and hydrocele fluid. On the sixth day minute pearly colonies were visible on the surface of the plates; microscopically these were made up of typical diplococci which decolorized by Gram. No other organisms were demonstrated in the pus.

The patient left the hospital in a couple of weeks but returned four months later. There was a persisting sinus at the site of the operation, and in the discharge tubercle bacilli were found. An intracapsular enucleation of the kidney was done.

There is one point in connection with this case which requires comment. At the time of the first admission no tubercle bacilli were found, but gonococci were cultivated; on the second admission tubercle bacilli were present but no gonococci were demonstrated, although cultures were not made. The question arises as to what relation the gonococcus bore to the abscess in the kidney. Did the gonococcus prepare the soil for a subsequent tuberculous infection? Or were the tubercle bacilli present from the beginning? It is not possible to answer these questions, but I am inclined to consider the case one of mixed infection; the gonococcus may have been a primary or secondary invader; the tubercle bacillus no doubt played the more important part in the suppurative process.

CASE 2. S. W., negress, aged forty-eight years, married; admitted to the Gynecological Department of the Johns Hopkins Hospital January 5, 1911.

Complaint. Pain in left side and back.

Family history, negative.

Personal history. General health of the patient has never been very good. About twenty-five years ago she had what may have been typhoid fever; continued fever for three weeks, associated with headache and delirium. Shortly after marriage she began to have a profuse yellow vaginal discharge, and for a time had some frequency and burning on urination. No cardiorespiratory symptoms, aside from a slight cough and slight dyspnœa on exertion. Patient is the mother of four healthy children. Menstrual history normal.

Present illness. Began thirteen years ago without any antecedent history of vesical disturbance. For this length of time patient has had attacks of pain in the left side which have come on irregularly, at first appearing two or three times a year, now coming every month or two. The attacks are characterized by sharp pain which begins in the region of the left kidney and radiates along the course of the left ureter; the pain is sharp in character and pretty constant with frequent colicky exacerbations, and when especially severe is accompanied by nausea and vomiting. She has had some increased frequency of urination, having to get up two or three times at night; she has noticed " corruption " in the urine but no blood.

The general condition of the patient is quite good, but the attacks of pain have become so severe and so frequent that she desires relief.

Physical examination. Revealed a well nourished woman. The general physical examination was negative. Heart and lungs were clear. In the abdomen nothing abnormal was made out; neither kidney was felt, and there was no tenderness. The pelvis was normal; ureters not thickened. A mucopurulent discharge from the urethra was present. Temperature slightly elevated, 99 to 100°. Pulse 90. W. B. C. 7,400. X-rays negative for stone. Ophthalmic tuberculin reaction negative.

The urine was cloudy, acid reaction, specific gravity 1015, albumen, no sugar. Microscopically many pus cells were present.

Cystoscopic examination. Bladder and urethra normal. Both ureteral orifices normal; purulent urine seen coming from left. Catheter entered both ureters with ease and passed into the kidney pelves. Cultures taken. 6 mmg. of phenolsulphonephthalein given intramuscularly and urine collected for one hour with the following results:

	Right kidney	Left kidney
Time of appearance of drug	8 min.	10 min.
Amount of urine	210 cc.	125 cc.
Amount of drug	40 per cent.	12.5 per cent.
Urea per liter	15 gm.	2 gm.
Microscopic examination	Negative	Many pus cells

Operation. Nephrectomy and partial ureterectomy, left.

Gross description of the kidney. The specimen consists of a kidney and a ureter about 5 cm. long. The kidney in its hardened state measures 8x5x4½ cm. The capsule over the lower third strips easily, while over the upper two-thirds it is densely adherent. The contrast between these two areas with the capsule stripped is quite marked: the lower part is yellow in color and has a smooth surface; the upper part presents a brownish mottled appearance, its surface is rough and shows several deep indentations; the mottled appearance is due to scattered areas of superficial hæmorrhage. On cut section the contrast is equally well marked; at the lower pole there is an area of yellowish gray kidney tissue 3x2 cm., which is doubtless a hypertrophy, compensatory in nature; Malpighian bodies are easily seen; the cortical striæ are obliterated. In the upper two-thirds there is no renal tissue left; it has been replaced by five or six abscess cavities which vary from 1 to 2 cm. in diameter; these cavities correspond to the indentations noticed on the surface. They are lined by rather firm granulation tissue; all of them communicate with the kidney pelvis more or less directly, and into those nearest the pelvis one can see the pelvic epithelium extending out, and some of them seem to be almost completely lined by epithelium. The abscesses are separated by dense fibrous tissue. The pelvis is contracted and greatly thickened. The epithelium is much increased in thickness and is here and there heaped up into white patches, raised above the surface, which resemble *leucoplakia buccalis*. There is nothing anywhere to suggest tuberculosis.

Microscopic description. The renal parenchyma shows evidence of compensatory hypertrophy; the tubules are somewhat distended; the cells are a little flattened and have undergone parenchymatous degeneration. The greater part of the kidney is made up of scar tissue in which one can see old and young fibroblasts, scattered round cells, and round cells collected in places, especially in the region of the pelvis, into definite lymph nodes with germinal centers. Section of the abscess walls shows them to be lined for the most part by granulation tissue with a loosely attached exudate; in the region of the kidney pelvis the pelvic epithelium has grown out so that in places a single layer of swollen cells completely encircles the cavity. The epithelium of the kidney pelvis, notably in the white patches mentioned above, has undergone a remarkable metaplasia, a transformation from the transitional to the squamous type. The cells have increased in number and those on the surface are flattened and have lost their nuclei. In a word, the epithelium is not dissimilar to skin epithelium. There is no evidence of acute infection and nowhere is there anything that resembles tuberculosis.

Stained smears of the fresh pus from the abscess cavities revealed the presence of large numbers of Gram-negative, biscuit-shaped diplococci, some of which were intra- and some extracellular. In the smears were seen also a few short Gram-negative bacilli. No tubercle bacilli found in acid-fast stains. In sections of the abscess walls, stained with Löff-

case they appeared as early as the tenth day, and in another as late as the tenth month. After the diagnosis was made and proper treatment instituted, the symptoms invariably cleared up within a short time. As to pyelonephritis, the cases are too few and the time of appearance too varied to warrant any definite conclusions; with the exception of Gerster's case, the disease ran a chronic course. Of the three cases of general infection with involvement of the kidney, all died. Internal measures or pelvic lavage effected a cure in all of the pyelitis cases. Two of the three cases of pyelonephritis came to autopsy; the third was relieved by nephrotomy and drainage.

AUTHOR'S CASES

To these collected cases I wish to add two others. I am under obligations to Dr. E. K. Cullen, in whose service the patient was admitted, for the privilege of reporting the second case. Dr. G. L. Hunner has very kindly put the bacteriological notes of the first case at my disposal.

CASE 1. L. C., female, white, aged twenty-two years, single; admitted to the Gynecological Department of the Johns Hopkins Hospital July 13, 1809.

Complaint. "Backache, sideache and bad-looking urine."

Family history, negative.

Personal history. General health fair. "Typhoid pneumonia" at thirteen years of age. Chills and fever every fall for five years. Menstrual history normal except for amenorrhœa for the past four months. Considerable leucorrhœal discharge lately.

Present illness. Patient has not been well for four years, although she has had no definite complaint until four months ago, when she began to have backache and pain in the left side and down the thighs. These symptoms have persisted. At the present time there is a constant desire to urinate during the day; patient has to get up three or four times at night. No pain or burning on urination. Urine has been cloudy at times. Patient has lost about ten pounds in weight in the last two months and there has been an increasing feeling of general weakness. During the past few months patient has had what she calls good days and bad days; perhaps for several days at a time she would feel well and the urine would be clear; then pain in the side would appear and the urine become cloudy and urination frequent.

Physical examination. Patient is an undernourished young woman. Mucous membranes rather pale. Heart and lungs negative. Abdomen: there is slight fullness in the left lumbar region, where on palpation an indefinite mass can be felt. The mass feels firm and is very tender. Pelvic examination negative, except that there is a urethral discharge; in smears from this were seen many typical biscuit-shaped, Gram-negative diplococci. Pulse 90, temperature 98° to 103°.

Urine cloudy, acid reaction, specific gravity 1020; many pus cells microscopically.

Cystoscopic examination. Bladder everywhere normal except for slight reddening about the left ureteral orifice. From the left ureter hangs a large drop of creamy pus which drops to the speculum and is succeeded by others. Urine from the right kidney clear. Attempt to catheterize the left ureter demonstrated an obstruction about 2 cm. from the ureteral orifice. No tubercle bacilli found in the urine.

Operation. Nephrotomy and drainage. About 150 cc. of thick, creamy, non-offensive pus was evacuated from an abscess cavity in the kidney substance. On examining the pus a few biscuit-shaped cocci were found. Plate cultures were made on equal parts of agar and hydrocele fluid. On the sixth day minute pearly colonies were visible on the surface of the plates; microscopically these were made up of typical diplococci which decolorized by Gram. No other organisms were demonstrated in the pus.

The patient left the hospital in a couple of weeks but returned four months later. There was a persisting sinus at the site of the operation, and in the discharge tubercle bacilli were found. An intracapsular enucleation of the kidney was done.

There is one point in connection with this case which requires comment. At the time of the first admission no tubercle bacilli were found, but gonococci were cultivated; on the second admission tubercle bacilli were present but no gonococci were demonstrated, although cultures were not made. The question arises as to what relation the gonococcus bore to the abscess in the kidney. Did the gonococcus prepare the soil for a subsequent tuberculous infection? Or were the tubercle bacilli present from the beginning? It is not possible to answer these questions, but I am inclined to consider the case one of mixed infection; the gonococcus may have been a primary or secondary invader; the tubercle bacillus no doubt played the more important part in the suppurative process.

CASE 2. S. W., negress, aged forty-eight years, married; admitted to the Gynecological Department of the Johns Hopkins Hospital January 5, 1911.

Complaint. Pain in left side and back.

Family history, negative.

Personal history. General health of the patient has never been very good. About twenty-five years ago she had what may have been typhoid fever; continued fever for three weeks, associated with headache and delirium. Shortly after marriage she began to have a profuse yellow vaginal discharge, and for a time had some frequency and burning on urination. No cardiorespiratory symptoms, aside from a slight cough and slight dyspnœa on exertion. Patient is the mother of four healthy children. Menstrual history normal.

Present illness. Began thirteen years ago without any antecedent history of vesical disturbance. For this length of time patient has had attacks of pain in the left side which have come on irregularly, at first appearing two or three times a year, now coming every month or two. The attacks are characterized by sharp pain which begins in the region of the left kidney and radiates along the course of the left ureter; the pain is sharp in character and pretty constant with frequent colicky exacerbations, and when especially severe is accompanied by nausea and vomiting. She has had some increased frequency of urination, having to get up two or three times at night; she has noticed " corruption " in the urine but no blood.

The general condition of the patient is quite good, but the attacks of pain have become so severe and so frequent that she desires relief.

Physical examination. Revealed a well nourished woman. The general physical examination was negative. Heart and lungs were clear. In the abdomen nothing abnormal was made out; neither kidney was felt, and there was no tenderness. The pelvis was normal; ureters not thickened. A mucopurulent discharge from the urethra was present. Temperature slightly elevated, 99 to 100°. Pulse 90. W. B. C. 7,400. X-rays negative for stone. Ophthalmic tuberculin reaction negative.

The urine was cloudy, acid reaction, specific gravity 1015, albumen, no sugar. Microscopically many pus cells were present.

Cystoscopic examination. Bladder and urethra normal. Both ureteral orifices normal; purulent urine seen coming from left. Catheter entered both ureters with ease and passed into the kidney pelves. Cultures taken. 6 mmg. of phenolsulphonephthalein given intramuscularly and urine collected for one hour with the following results:

	Right kidney	Left kidney
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Urea per liter	15 gm.	2 gm.
Microscopic examination	Negative	Many pus cells

Operation. Nephrectomy and partial ureterectomy, left.

Gross description of the kidney. The specimen consists of a kidney and a ureter about 5 cm. long. The kidney in its hardened state measures 8x5x4½ cm. The capsule over the lower third strips easily, while over the upper two-thirds it is densely adherent. The contrast between these two areas with the capsule stripped is quite marked: the lower part is yellow in color and has a smooth surface; the upper part presents a brownish mottled appearance, its surface is rough and shows several deep indentations; the mottled appearance is due to scattered areas of superficial hæmorrhage. On cut section the contrast is equally well marked; at the lower pole there is an area of yellowish gray kidney tissue 3x2 cm., which is doubtless a hypertrophy, compensatory in nature; Malpighian bodies are easily seen; the cortical striæ are obliterated. In the upper two-thirds there is no renal tissue left; it has been replaced by five or six abscess cavities which vary from 1 to 2 cm. in diameter; these cavities correspond to the indentations noticed on the surface. They are lined by rather firm granulation tissue; all of them communicate with the kidney pelvis more or less directly, and into those nearest the pelvis one can see the pelvic epithelium extending out, and some of them seem to be almost completely lined by epithelium. The abscesses are separated by dense fibrous tissue. The pelvis is contracted and greatly thickened. The epithelium is much increased in thickness and is here and there heaped up into white patches, raised above the surface, which resemble *leucoplakia buccalis*. There is nothing anywhere to suggest tuberculosis.

Microscopic description. The renal parenchyma shows evidence of compensatory hypertrophy; the tubules are somewhat distended; the cells are a little flattened and have undergone parenchymatous degeneration. The greater part of the kidney is made up of scar tissue in which one can see old and young fibroblasts, scattered round cells, and round cells collected in places, especially in the region of the pelvis, into definite lymph nodes with germinal centers. Section of the abscess walls shows them to be lined for the most part by granulation tissue with a loosely attached exudate; in the region of the kidney pelvis the pelvic epithelium has grown out so that in places a single layer of swollen cells completely encircles the cavity. The epithelium of the kidney pelvis, notably in the white patches mentioned above, has undergone a remarkable metaplasia, a transformation from the transitional to the squamous type. The cells have increased in number and those on the surface are flattened and have lost their nuclei. In a word, the epithelium is not dissimilar to skin epithelium. There is no evidence of acute infection and nowhere is there anything that resembles tuberculosis.

Stained smears of the fresh pus from the abscess cavities revealed the presence of large numbers of Gram-negative, biscuit-shaped diplococci, some of which were intra- and some extracellular. In the smears were seen also a few short Gram-negative bacilli. No tubercle bacilli found in acid-fast stains. In sections of the abscess walls, stained with Löff-

ler's methylene blue were found a moderate number of diplococci which decolorized by Gram; no organisms were seen beyond the abscess walls. In addition a few short bacilli were present. No organisms showed up in sections stained by Gram's method.

From cultures taken on slant agar from the right kidney by ureteral catherization was isolated an organism with these characteristics: short, actively motile, Gram-negative, bacillus; clouded bouillon, caused slight initial acidity in milk; fermented neither glucose nor saccharose; did not liquefy gelatine; formed no pigment,—characteristics of the bacillus typhosus. No coccus grew on the media used.

This case is interesting for several reasons. Of course, it is impossible to say how long the gonococcus had been present in the kidney; we can only speculate and such a speculation brings up the question as to how long the gonococcus can survive in the body. Noeggerath's conclusion, drawn over forty years ago, that " gonorrhœa in a male as well as in a female persists for life in certain sections of the organs of generation, notwithstanding its apparent cure in a great many cases," is no doubt pessimistic; yet cases do occur which would tend to give support to his " once infected, always infected " doctrine. Allen (43) and Ruggles (44) have each reported instances where, if the history be reliable, the first and only gonorrhœal infection had been ten years previously. The patient here reported had had symptoms from her kidney at intervals for thirteen years. It is not impossible that the gonococcus played some part in these recurring renal attacks just as it does in urethral or prostatic flare-ups.

Aside from the presence of gonococci, the most unusual feature of the microscopic picture was the remarkable metaplasia of the epithelium of the kidney pelvis. Such a transformation occurs occasionally in longstanding stone cases, but I know of no similar case where the condition was observed in chronic inflammation of the kidney pelvis.

And then the occurrence of typhoid bacilli in the urine from the infected kidney is of interest. The patient had what was probably typhoid fever twenty-five years before. I have found no other case where the organism persisted in the urine for such a long time.

CONCLUSIONS

1. Gonococcal infections of the kidney are quite rare; excluding the cases associated with general septicemia and including the two cases here reported, there are twelve authentic cases—six pure and six mixed.

2. The condition occurs more frequently in men; this may be accounted for by the prevalence of gonorrhœa in men.

3. Hematogenous infection would seem to play a more important rôle than the ascending type.

4. The symptoms are not different from those caused by other organisms.

5. Nothing short of a satisfactory demonstration of the gonococcus in the kidney or in the secretions from the kidney is sufficient to justify the diagnosis.

6. No case of suppuration in the kidney has been proven conclusively to be due to the gonococcus alone; in all probability a mixed infection is present in all such cases.

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TUBERCULOSIS OF THE TUBES, OVARIES, AND BLADDER[1]

BY G. KOLISCHER, M. D., CHICAGO, ILLINOIS

IT is the aim of this paper to discuss only the leading points of this subject so as to present the question in its present aspect according to the most recent and reliable sources.

It can be said at once, that the Fallopian tubes are predominant in tuberculosis of the female genitals. Modern research has proved that tuberculosis of the tubes is more frequent than was formerly believed and that, as a general statement in tuberculosis of the female genitals, the tubes will be the first structures to be attacked; and, as a rule, bilaterally. Mixed infection, preferably with gonococci, will occur, but it is impossible to conclusively decide whether the gonorrhœal or the tubercular infection was the primary one. Most authors, however, hold that the tubal mucosa once changed by a gonorrhœal inflammation furnishes an excellent soil for the colonization and proliferation of the tubercle bacilli.

This contention becomes rather plausible if one considers that tuberculosis of the tubes sometimes will follow a previous non-gonorrhœal infection, for instance puerperal infection produced by other pyogenous microbes. As to the route over which the tubercle bacilli invade the tubes, some authors claim that the germs may be imported through the deposition in the vagina of semen that contained tubercle bacilli, thus assuming that these microbes establish themselves in the tubes without damaging any of the tissues interposed between vagina and Fallopian tubes. Most of the authors however are now of the opinion that the tubercular

[1] Read before the joint meeting of the Chicago Surgical, Gynecological, and Urological Societies, February 3, 1911. (See p. 391.)

infection of the tubes is either hematogenous or lymphogenous.

The old idea that tuberculosis of the adjacent peritoneum is the cause of tuberculosis of the tubes has been dropped in favor of the conviction that if there should occur coexistence of peritoneal and tubal tuberculosis, it is always the tubal infection that was the primary one. Tuberculosis of the tubes appears either in an acute or a chronic form. The disease is always most pronounced at the free end of the tube, so that the well known club shaped formation of the tubercular tube is developed. Rapidly progressing tuberculosis may lead to the formation of large tumors at the distal end of the tube and to the accumulation of cheesy debris that protrudes out of the abdominal ostium of the tube.

Most chronic forms lead to the occlusion of the fimbrial end and to the formation of pus sacs. The so-called fibrous form of tuberculosis of the tubes does not seem anything else but cicatricial sequestration of the tubercular foci leading to a cure by natural forces.

The clinical symptomatology of tuberculosis of the tubes is formed by a combination of the symptoms that we are used to find in any case of inflammation of the uterine appendages and of those symptoms that are due to the specific influence of tuberculosis on the human system. So we observe disturbances of menstruation, it becomes more frequent and more copious, every exacerbation of the process provokes uterine hæmorrhages; as long as it is possible to differentiate the tubes, they show to the palpating fingers the characteristic club shaped form. While the tubes are always sensitive to the touch, spontaneous pain seems to be dependent on the involvement of the peritoneum; pronounced fever seems to be contingent on the formation of pus sacs.

The general health always is considerably impaired. The diagnosis cannot be made from the local findings alone. But if we sum up anamnesis, hereditary incumbrance, course of the disease, the presence of active or latent tuberculosis in other organs with characteristic local findings, the diagnosis of a tubercular salpingitis may be pretty surely established. As another decisive factor typical reaction after tuberculin injection should be considered.

Extirpation of the tubercular tubes will furnish satisfaction only in the initial stages; some authors claim that if any operative interference be considered at all, a radical operation has to be undertaken, that is, removal of the uterus and the appendages. But it must be remembered that experience has proven that any operative interference in tuberculosis of the internal female genitals is apt to be followed by a dissemination of tuberculosis, such as tubercular sinuses in the abdominal wall, miliary tuberculosis, or tubercular meningitis. It seems from the viewpoint of our present knowledge that tuberculosis of the tubes ought to be treated in the same way as other forms of localized tuberculosis; that is, surgery ought to be restricted to the most urgent indications, so to say, to the surgical necessities, while the greatest stress must be laid on the general treatment, under which the judicious use of tuberculin must be considered. Such results in genital tuberculosis as were obtained and reported by McArthur, Belfield, Billings, Karo, cannot simply be ignored, but should influence our therapeutic efforts.

It also can be said of ovarian tuberculosis, that it occurs more frequently than was formerly believed, although ovarian tuberculosis is rarer than that of the tubes. This disease of the ovaries manifests itself as a rule through the formation of cheesy nodules. Tubercular infection of pathologically changed ovaries (ovarian cysts) also has been observed.

While the possibility of a primary tuberculosis of the ovaries cannot be theoretically denied, most authors coincide in the opinion that in the overwhelming majority of cases the ovarian tuberculosis is secondary mainly by direct infection from the tubes; as port of entrance a corpus luteum is recognized.

The therapeutic efforts have to be guided by the principles laid down above.

The first question that will force itself upon the essayist discussing tuberculosis of the bladder will be: Is there such a thing as primary tuberculosis of the bladder? It may

be worth while to enter into an analysis of the term, primary tuberculosis of the bladder. It is highly improbable that any of the urinary organs should be the first and only point of entrance and colonization of the tubercle bacilli; it is more reasonable to assume that the tubercle bacilli have entered the system through the well known ports of entrance and have started foci in the familiar places of predilection; from there they have entered the circulation and in the later course of events have located in the urinary organs. So if we say for instance that the bladder was secondarily infected from the primary renal tuberculosis, that means only the order of successive infection and manifest clinical evidence, the really primary foci of the infection may at this stage be entirely healed up and calcified.

It seems therefore more appropriate to speak of solitary tuberculosis of the bladder; it cannot be denied that such solitary tuberculosis of the bladder will occur occasionally; there are cases of ulcerative tuberculosis of the vesical mucosa on record, that were cured by vesical interferences only, so that the assumption is justified that at this time the tuberculosis was confined to the bladder only. I furthermore want to call attention to the tuberous form of tuberculosis that I described as occurring in the female bladder; still it has to be admitted, that the great majority of cases of vesical tuberculosis are due to infection coming from a pre-existent renal tuberculosis.

It has to be stated that there is a marked difference in the clinical evidence of vesical tuberculosis in the male and in the female. The course of the disease in the female is as a rule of a milder character, very probably because there does not exist such an interdependence between the genital and urinary organs as is the case in the male; we therefore not infrequently encounter in the female the so-called latent vesical tuberculosis, that is, a condition in which tubercular changes in the vesical mucosa can be demonstrated although the subjective symptoms are very mild and not characteristic at all.

For practical purposes we differentiate between tuberculosis of the bladder and cystitis tuberculosa, meaning that in the cases of the first group isolated tubercular foci are to be found in the bladder wall, while the second group is characterized by extensive tubercular inflammation of the mucosa leading to a preponderance of the symptoms commonly ascribed to cystitis.

In diagnosis of tuberculosis of the bladder two leading principles must always be kept in mind, firstly, that the subjective symptoms are not always in proportion to the intensity and extent of the tubercular infection and subsequent destruction, and secondly, that in all cases of tubercular infection the bladder shows a reduction of its normal capacity, which manifests itself in a decided resistance against dilation, this may vary as to degree but is always evident, it is as a rule less pronounced in the natural distension of the bladder by the urine, but very marked in artificial dilation through injection of fluid or though inflation with air. Therefore, in all cases of frequent urination, or in cystitis in young individuals in whom infection other than tuberculosis can be excluded, urinary tuberculosis must be thought of and an appropriate investigation started. It must also be considered that in women quite frequently tuberculosis of the urinary organs can be overshadowed by more conspicuous gynecologic abnormities, as myomata, displacement of the uterus, and so on, conditions which occasionally may lead to vesical disturbances. In other words every doubtful case must be considered as highly suspicious of tuberculosis, until the contrary is proven. The first step will always be systematic examination of the urine by sedimentation, centrifugalizing for microscopical examination, by culture, and inoculation test.

The next step is the cystoscopic examination of the bladder. In some cases the bladder is already so intolerant that the cystoscopy even under general anæsthesia is impossible, but in most of the cases a satisfactory cystoscopy can be executed, especially if we resort to a method that has in my experience proven to be very useful; one cystoscopes not after the usual flushing out and refilling of the bladder, but while it is filled with urine.

In order to get the urine as transparent as possible the patient is advised to drink tea an hour before the time set for examination, or to take some urotropin with plenty of water. Then the bladder, not having been excited by introduction of a catheter and by manipulations of flushing and refilling, will show adequate tolerance.

In tuberculosis of the vesical mucosa the cystoscopic pictures vary according to the duration of the disease. In the earliest stages one sees on the otherwise normal mucosa little nodules of various size, but always rather small. These nodules are round, yellowish gray in color, and usually surrounded by a tiny wreath of blood-vessels. These nodules appear as a rule arranged in little groups. Sometimes these nodules are arranged closely alongside a blood-vessel and some of them appear at the ends of the ramifications of this blood-vessel, so that one gets a picture to be likened to the arrangement of grapes on a vine.

In later stages some or all of these nodules show central ulcerations with a miscolored base, each ulcer is surrounded by a red areola; sometimes several of these ulcers unite and form bigger plaques. The mucosa between these ulcers appears red and swollen.

Nodules and ulcers are always located in the trigonum and preferably near and around a ureteral opening, thus indicating the character and source of infection.

Once in awhile the ureteral opening is also infected by tuberculosis and then it will appear as the center of a crater of dark red color with ragged edges. Bloody suffusions of the mucosa around the ureter and between the ulcerations are not infrequent.

In some cases of tubercular cystitis, if it is possible at all to cystoscope the patient, part of or the whole trigonum appears as a uniformly red surface, that gives the impression of being swollen. In some, yellow nodules may be seen.

Mixed or subsequent infections give the usual picture of cystitis; if appropriate treatment has succeeded in partially clearing up the bladder a picture more characteristic for tuberculosis may be found at the occasion of cystoscopy executed at this time.

In doubtful cases I wish to suggest a procedure that repeatedly stood me in good stead.

If a cystoscopy has given undecided results, the second cystoscopy is undertaken at a time when a diagnostic tuberculin injection has provoked reaction; then the reaction will also show in the bladder provided there is any tuberculosis there; the nodules appear more prominent, the red areola is very pronounced, the edges of the ulcers appear intumescent, the afflicted ureteral ending protrudes distinctly into the bladder.

In cases of tuberous tuberculosis one sees as a rule closely to the internal urethral orifice a solitary tumor, that protrudes into the field of view like a fingertip. The surface of this growth appears uneven and scaling, the top is as a rule occupied by an ulcer with miscolored bottom and ragged undermined edges; it seems to be characteristic that even after long existence these ulcers do not become incrusted as invariably occurs in exulcerations on malignant tumors.

The rest of the mucosa appears to be normal, as also the ureteral openings. In any cystoscopy for tuberculosis of the bladder it is an established principle that the cystoscopy is conducted with the purpose of ascertaining whether one or both kidneys are also infected by tuberculosis.

The therapeutic efforts are conducted on lines furnished by the above mentioned pathologic and diagnostic details.

In solitary forms of tuberculosis excision and suture will suffice for a cure; the majority of cases however have to be treated by curing the primary renal focus. After this is once attended to, the vesical tuberculosis as a rule will heal up spontaneously; only in stubborn cases additional local interference has to be resorted to. We attempt to cure the ulcerations and other cystitic manifestations by instillations of argyrol or bichlorid solutions; in case those should not suffice, the actual cautery introduced through an operative cystoscope must be employed. Tuberculin also must be utilized.

THE VALUE OF CHROMOURETEROSCOPY IN FUNCTIONAL KIDNEY DIAGNOSIS[1]

By B. A. THOMAS, A. M., M. D., Philadelphia, Pennsylvania
Professor of Genitourinary Surgery in the Philadelphia Polyclinic Hospital and College for Graduates in Medicine; Surgeon-in-Chief to the Outpatient Department of the University Hospital; Instructor in Surgery in the University of Pennsylvania

THERE are several motives prompting the presentation of this more extensive and comprehensive study of the value of indigocarmin in urological diagnosis, supplementary to the preliminary report[2] on this subject by me some two years since; firstly, because of corrections necessitated by the earlier onset of elimination and other time factors in the excretion of the dye; secondly, because of increased interest in its use generally, and particularly in the various types of nephritis; also retention of urine incident to urethral obstruction by prostatic enlargement, etc.; and, thirdly, because chromoureteroscopy, with the employment of indigocarmin is the most valuable individual functional kidney test, I believe, that we possess, because of its simplicity and almost universal applicability.

For forty years it has been well known in the medical world that dyes, injected subcutaneously, have been able to demonstrate in some instances the sufficiency or insufficiency of the kidneys. However, the test as applied by the French with the employment of methylene blue, rose anilin, etc., was doomed soon to fall into disrepute, owing to the inconstancy of the color reaction after the injection of these substances. It remained for Völcker and Joseph, seven years ago, therefore, by their advocacy of indigocarmin as a practical functional kidney test, particularly for the use of the surgeon, to place chromoureteroscopy permanently at the disposal of the urologist. To-day, the steadily increasing employment and practical value of this most useful of kidney tests is undeniable. Its recommendation recently by such authorities as Thelen, Suter, König, Blum, Prigl, Roth, Zangemeister, Döderlein and Krönig attests to the great value of the test and will exert a far-reaching influence for its universal adoption.

It is to be distinctly understood that in urging the more extensive employment of indigocarmin in urological diagnosis, I do not mean for a moment that chromoureteroscopy is to or should supplant ureteral catheterization in all instances; that is impossible. For instance, the great value of ureteral catheterization supplementary to chromoureteroscopy in such diseases as incipient tuberculous nephritis, pyelitis, and ureteral calculus is indisputable. In the last condition and equally so in renal calculus the assistance of the X-ray is not to be ignored, for neither is chromoureteroscopy nor ureteral catheterization nor the Röntgen ray infallible individually, but used conjointly they will seldom fail to establish the diagnosis. The greatest evil of twentieth century medicine is the search for some pathognomonic sign or symptom in order to make a diagnosis, to the total exclusion of other available measures of proven worth. I do wish to state emphatically, however, that where the indigocarmin test has been properly and intelligently applied, ureteral catheterization supplemented by the usual functional renal tests, namely, cryoscopy, determination of artificial glycosuria following the injection of phloridzin, determination of urea, estimation of the electrical conductivity of urine, etc., will not be required in more and probably less than ten per cent of cases. Such a routine, in many instances, is positively impossible, owing to inability to catheterize both ureters synchronously, which procedure is the fundamental dictum of Casper. Chromoureteroscopy, most satisfactorily performed with the use of an evacuation cystoscope, is so simple that it is applicable to practically every case, the only exception being excessive hematuria

[2] "Chromocystoscopy in Functional Renal Diagnosis Based upon the Employment of Indigocarmin." Read before the Pennsylvania State Medical Society meeting held at Cambridge Springs, September, 1908, and subsequently published in Surgery, Gynecology and Obstetrics, April, 1909.

[1] Read by invitation before the Philadelphia Academy of Surgery, April 4, 1910.

where any form of cystoscopy becomes impossible. Indeed, although a general anæsthetic is rarely necessary, should such be the case, the indigo test may readily be applied in a few minutes prior to operation and during the same anæsthetization. The intravesical findings are so simple and obvious that but a few minutes are necessary frequently to diagnose the condition of the affected side and prognose the functional sufficiency of the supposedly normal organ in view of nephrotomy or nephrectomy.

One point that I desire especially to emphasize is the maintenance of the simplicity of the test, namely, a careful examination of the interior of the bladder with a simple evacuation cystoscope, supplemented by a knowledge of pathology sufficient to interpret the significance of the findings, until the elimination of the dye begins. Consequently, the cystoscopist should also be a pathologist, and he is just as much entitled to know the history and physical examination of his patient, before making a diagnosis from the chromoureteroscopic findings, as is the pathologist to have the history of his patient and to examine and know from what part of the body the gross specimen was removed before rendering his opinion. Fortunately, in the vast majority of instances, this is unnecessary, as the chromoureteroscopic findings alone usually suffice to make the diagnosis, and in my experience, have always proved absolutely reliable in prognosing the sufficiency of the supposedly unaffected kidney. Indeed, recently in a case, where the clinical symptoms pointed unmistakably to renal disease in support of which there was some intravesical evidence, in opposition to contradiction by the elimination of indigocarmin, an exploratory nephrotomy was advised and performed revealing an absolutely normal kidney.

So soon as the indigo appears the undivided attention of the observer must be concentrated upon the ureteral orifices synchronously or alternately, noting exactly the time of the onset of the excretion of indigo following its intramuscular injection; also the intensity of the color reaction, whether dark blue or light blue, and if the latter, whether or not the color becomes subsequently intensified throughout a total period of one-half hour; also the condition of the ureteral orifices, their contractile and expansile movements, the manner of the ejection of the blue colored urine as governed by ureteral peristalsis, and the presence or absence of disease in or about the orifices, and finally, but actually before the onset of the elimination of the blue, the conditions of the ejected urine, whether perfectly clear or containing blood or pus.

Kapsammer has strenuously advocated the association of the indigocarmin test with ureteral catheterization, noting the appearance of the dye from the proximal end of the catheters. This procedure to my mind is a grave mistake for the following reasons: 1. In many cases the indigocarmin test is applicable and trustworthy, when ureteral catheterization, particularly bilateral, is impossible. 2. Not infrequently the eye of the catheter will become occluded by mucous membrane, blood, or pus, preventing the elimination of the indigo through the catheter, whereas it may be observed to escape from around the catheter into the bladder. This accident, it is alleged, may be prevented by selecting properly sized catheters, but it must be remembered that the lumina of ureters vary, and before this point is determined, the value of the test is jeopardized. 3. The introduction of a catheter into the ureter may so affect the mechanism of ureteral peristalsis, if not the renal function, reflexly, that the frequency and manner of ureteral peristalsis and the attendant elimination of urine and indigo may depart widely from the normal.

At the University Hospital, for a period of six years, the mortality following operations upon the kidney was over 15 per cent. Since 1906, in the operated kidney cases where the indigocarmin test was applied, there has not been a single death from insufficiency of the supposedly normal sister organ. Personally, therefore, I regard it a crime for any surgeon to perform a nephrotomy or nephrectomy until he has determined previously the functional sufficiency of the apparently unaffected kidney.

Conclusions as to the functional sufficiency or insufficiency of a kidney, based merely upon the *onset* of the elimination of indigo-

carmin may be erroneous. The *intensity* of the color reaction must also receive serious consideration. Therefore the first law of the chromoureteroscopist is to obtain and maintain an absolutely clear fluid content in the bladder. The second law is to have a sufficiently brilliant illumination. If these two conditions are not secured, he will frequently fail to observe the earliest onset of the elimination of the indigo, particularly if it is a light blue coloration and merely oozes from the ureteral orifices into the bladder, instead of exhibiting the normal spurt. The first law can be best fulfilled by prolonged irrigation, if indicated, and the employment of an evacuation cystoscope, so that the bladder may be quickly emptied and refilled when necessary. The second law is not so difficult, requiring simply care in the selection of a good cystoscope and the testing of the lamp before introduction into the bladder.

REPORT OF CASES WITH NORMAL KIDNEYS SHOWING DIAGNOSIS, TIME OF ELIMINATION IN MINUTES FOLLOWING THE INJECTION OF INDIGOCARMIN, AND TREATMENT

CASE 1. Harry I., aged 24; cystitis tuberculosa; right kidney, 9 m.; dark blue (slight); left kidney, 9 m.; dark blue (moderate). Exploratory nephrotomy showed left kidney twice size of normal due to congestion. No t. b.

CASE 2. George H., aged 47; prostatic enlargement, trabecular hypertrophy of bladder; right kidney, 19 m.; dark blue; left kidney, 19 m.; dark blue. Discharging sinuses about right hip for 10 years. No evidence of bone or joint disease. Bismuth and X-ray showed sinus to right kidney region. Symptoms of appendicitis years since. Bacterin therapy.

CASE 3. James S., aged 23; chronic cystitis coli; trabecular hypertrophy of bladder; right kidney, 11 m.; dark blue; left kidney, 11 m.; dark blue. Urinary antiseptics.

CASE 4. Mary B., aged 52; ulcerative granulomatous tuberculosis of bladder; right kidney, 20 m.; dark blue; left kidney, 20 m.; dark blue. Suprapubic cystotomy advised and refused. Discharged.

CASE 5. William A., aged 32; chronic prostatis and cystitis coli; right kidney 8½ m.; dark blue; left kidney, 8½ m.; dark blue. Urinary antiseptic and prostatic massage.

CASE 6. William M. B., aged 18; dilatation of bladder; right kidney, 13 m.; dark blue; left kidney, 13 m.; dark blue. Excess of urates from right kidney. Antiseptics.

CASE 7. Carl F. B., aged 35; chronic posterior urethritis; prostatitis; seminal vesiculitis and cystitis; right kidney, 10 m.; dark blue; left kidney, 15 m.; dark blue. Only 3 or 4 drops of fluid collectible from catheter introduced into left ureter, but indigo was eliminated profusely around catheter into bladder.

CASE 8. Frank B., aged 34; strictures of urethra; trabecular hypertrophy of bladder; right kidney, 5 m.; dark blue; left kidney, 5 m.; dark blue. Urinary antiseptics and urethral sounds.

CASE 9. Richard S., aged 45; prostatic hypertrophy; subacute cystitis; trabecular hypertrophy of bladder; right kidney, 15 m.; dark blue; left kidney, 17 m.; dark blue. Smears and guinea-pig inoculations negative for tuberculosis. Urinary antiseptics and passage of full sized cold steel sounds.

CASE 10. Joseph K., aged 24; contracted meatus; urethral strictures; subacute cystitis and trabecular hypertrophy of bladder; right kidney, 6 m.; dark blue; left kidney, 6 m.; dark blue. Meatotomy; urethral dilatation and antiseptics.

CASE 11. Mary D., aged 27; cholecystitis with hydrops, complicating typhoid fever; subacute typhoidal cystitis; right kidney, 11 m.; dark blue; left kidney, 11 m.; dark blue. Chromocystoscopy determined the differential diagnosis between hydronephrosis and cholecystitis.

CASE 12. William C., aged 49; prostatic enlargement; ulcerative cystitis; trabecular hypertrophy of bladder; right kidney, 19 m.; light blue. Palliative treatment. Improvement.

CASE 13. Mike E., aged 22; vesical fistula; ulcerative tuberculous cystitis; right kidney, 12 m.; dark blue; left kidney, 15 m.; dark blue. Refused treatment. Discharged.

CASE 14. Wm. D. G., aged 38; bifurcation of left ureter; right kidney, 10 m.; dark blue; left kidney, 10 m.; dark blue. Expectant treatment. Indigo was seen to be eliminated from both ureteral orifices on the left side, but when the catheter was introduced a few cm. into one of the orifices, there was no blue from the other, the entire elimination occurring through the catheter.

CASE 15. Mark J., aged 18; contracted urinary meatus; cystitis; trabecular hypertrophy; right kidney, 9 m.; dark blue; left kidney, 9 m.; dark blue. Meatotomy. Palliative treatment.

CASE 16. Edward W., aged 21; stricture of posterior urethra; chronic cystitis; trabecular hypertrophy of bladder; right kidney, 16 m.; dark blue; left kidney, 9 m.; dark blue. Meatotomy, urinary antiseptics, and sounds.

CASE 17. Frank F., aged 24; lumbago; right kidney, 5 m.; dark blue; left kidney, 5 m.; dark blue. No urological treatment.

CASE 18. S., aged 50; hypertrophied prostate; trabecular hypertrophy of bladder; calculous incrustations; right kidney, 12 m.; light blue; left kidney, 12 m.; light blue.

CASE 19. Jesse T. W., aged 24; contracted external urinary meatus; urethritis; inguinal lym-

phadenitis; right kidney, 7 m.; dark blue; left kidney, 7 m.; dark blue. Urinary antiseptics.

CASE 20. George E.. aged 58; prostatic hypertrophy; trabecular hypertrophy of bladder; calculus; right kidney, 13 m.; dark blue; left kidney, 13 m.; dark blue. Perineal prostectomy. Recovered.

CASE 21. Bessie S., aged 23; neurasthenia; right kidney, 13 m.; dark blue; left kidney, 12 m.; dark blue. Tonics.

CASE 22. Jos. T. H., aged 43; chronic cystitis; perineal fistula; right kidney, 9 m.; dark blue; left kidney, 9 m.; dark blue. Repair of fistula, treatment of strictures and antiseptics.

CASE 23. Alvin K., aged 44; greatly contracted external urinary meatus; right kidney, 14 m.; dark blue; left kidney, 14 m.; dark blue. Meatotomy.

CASE 24. Wm. E. K., aged 26; ulcerative tuberculous cystitis (primary); right kidney, 10 m.; dark blue; left kidney, 10 m.; dark blue. Antituberculous remedies; bichloride irrigations, etc.

CASE 25. Fanny H., aged 20; subacute cystitis; right kidney, 7 m.; dark blue; left kidney, 7 m.; dark blue. Urinary antiseptics.

CASE 26. Patk. J. McM., aged 50; chronic cystitis; contracted bladder with diverticulum; right kidney, 20 m.; dark blue; left kidney, 20 m.; dark blue. Rest and irrigations.

CASE 27. William T., aged 35; nephralgia; right kidney, 12 m.; dark blue; left kidney, 8 m.; dark blue. Urinary diluents and antiseptics.

CASE 28. Wm. K. M., aged 22; acute catarrhal cystitis; right kidney, 8 m.; dark blue; left kidney, 10 m.; dark blue. Sedatives and urinary antiseptics.

CASE 29. Harvey H., aged 52; subacute and ulcerative cystitis; chronic gonorrhœal prostatitis; right kidney, 10 m.; dark blue; left kidney, 10 m.; dark blue. Urinary antiseptics.

CASE 30. Dixon H., aged 45; mitral regurgitation; right kidney, 9 m.; dark blue; left kidney, 9 m.; dark blue. Four weeks previously suffered from lost cardiac compensation, the urine showing evidence of renal congestion. At time of cystoscopy urinalysis was negative.

REPORT OF CASES WITH DISEASED KIDNEYS SHOWING DIAGNOSIS, TIME OF ELIMINATION IN MINUTES FOLLOWING THE INJECTION OF INDIGOCARMIN, AND TREATMENT

HYDRONEPHROSIS

CASE 1. Lydia F., aged 46; Hydronephrosis; obliteration of right ureteral orifice; right kidney, 30 m.; nil; left kidney, 12 m.; dark blue. Nephrectomy. Recovery. Kidney greatly enlarged. Pelvis markedly dilated with pressure atrophy of parenchyma.

NEPHRITIS

CASE 2. Robert T., aged 31; hæmorrhagic (unilateral, left); right kidney, 10 m.; dark blue; left kidney, 30 m.; nil. Nephrotomy revealed no gross lesion of kidney. Subsequently hæmorrhage from the kidney into the bladder necessitated suprapubic cystotomy and nephrectomy. *Recovery* with marked gain in weight.

CASE 3. Thurman C., aged 21; chronic parenchymentous; right kidney, 9 m.; light blue; left kidney, 9 m.; light blue. Urinalysis six days prior to cystoscopy revealed a sp. gr. of 1007, a trace of albumen, no casts, no erythrocytes. On admission when patient was in attack of typhoid fever, total quantity of urine for 24 hours was 4,800 cc.; there was a small amount of albumen, granular and leucocytic casts, many erythrocytes. Subsequently amount of albumen was one-sixth by volume and epithelial casts were present.

CASE 4. James B., aged 51; chronic parenchymentous; right kidney, 9 m.; dark blue; left kidney, 9 m.; dark blue. The elimination of indigo was weak. Urinalysis: sp. gr. 1010, cloud of albumen, one gram per mille (0.5 per cent Goodman) hyaline, pale and dark granular casts. systolic blood pressure was 195, diastatic blood pressure was 100.

CASE 5. Howell F., aged 17; chronic interstitial; right kidney, 30 m.; nil; left kidney, 20 m.; light blue. Urinalysis on day before examination of 2,660 cc., being a 24 hour collection, showed a sp. gr. of 1005, albumen 0.11 per cent (Goodman), chlorides 2.03 grams.

CASE 6. Jennie C., aged 11; chronic parenchymentous; right kidney, 14 m.; light blue; left kidney, 9 m.; light blue. Previously had decapsulation of right kidney, at which time sp. gr. was 1045, and albumen measured 10 grms. per mille, at time of cystoscopy sp. gr. was 1020 and albumen .5 grms. per mille.

CASE 7. Stella C., aged 31; acute unilateral hematogenous suppurative; right kidney, 7 m.; dark blue; left kidney, 7 m.; dark blue. Right ureter catheterized and urine cultures demonstrated. B. Friedlander. Pain, tenderness and palpable right kidney. Nephrectomy. *Recovery.* One-half of kidney involved in a congested central area, profusely impregnated with miliary suppurative foci.

NEPHROLITHIASIS

CASE 8. Charles J., aged 25; small calculus in left kidney, vesical calculi, granules and sand in trigonum; right kidney, 7½ m.; dark blue; left kidney, 8 m.; dark blue. Nephrolithotomy. *Recovery.* Small stone removed from kidney.

CASE 9. Lewis V., aged 20; Nephrolithiasis (left); right kidney, 10 m.; dark blue; left kidney, 15 m.; dark blue. Nephrolithotomy. *Recovery.*

CASE 10. George W., aged 47; calculus of right kidney; pyelonephritis (left); right kidney, 30 m.; nil; left kidney, 18 m.; light blue. Discharged. Operation contraindicated. Diagnosis confirmed by X-ray.

CASE 11. Louise W., aged 22; calculus in pelvis of right kidney; left kidney, 8½ m.; dark blue. Catheterization of right side for suspected ureteral calculus interfered with indigo elimination. Catheter

passed to kidney and tip completely bent upon itself.

CASE 12. Annie M., aged 48; nephrolithiasis (left); pyonephrosis; right kidney, 10 m.; dark blue; left kidney, 30 m.; nil. Nephrectomy. *Recovery.* Three large branching calculi filled calices. Small portion of kidney was normal.

CASE 13. Tillie W., aged 26; nephrolithiasis (right); right kidney, 7½ m.; dark blue; left kidney, 19 m.; dark blue. Very small vesical calculi clinging to mucosa. Evidence of traumatism to right ureteral orifice, probably due to recent passage of stone. Discharged.

CASE 14. Jacob D. K., aged 52; renal calculus (right); right kidney, 20 m.; nil; left kidney, 18 m.; dark blue. Not treated.

CASE 15. Elizabeth S., aged 30; calculus in pelvis of right kidney; pyonephrosis; right kidney, 30 m.; nil; left kidney, 4½ m.; dark blue. Nephrolithotomy. *Recovery.* Ureteral catheter introduced into right ureter was arrested 26 cm. from the ureteral orifice by the calculus which later was found to occlude the upper end of the ureter.

CASE 16. J. Albert P., aged 30; renal calculus; pyonephrosis; ulcerative cystitis; right kidney, 20 m; nil.; left kidney, 7 m.; dark blue. Nephrotomy. *Recovery.* Stone was very large, almost filling kidney.

CASE 17. Wm. R. L., aged 35; renal calculus (right); right kidney, 11 m.; dark blue; left kidney, 10 m.; dark blue. Nephrolithotomy. *Recovery.* Calculus measured 2 x .75 cm. in dimensions. X-ray diagnosis.

CASE 18. Grace M., aged 22: calculi: pyonephrosis; cyst of kidney (right); right kidney, 30 m.; nil; left kidney, 7 m.; dark blue. Nephrolithotomy. *Recovery.* At least one-half of kidney substance had disappeared through disease of various forms.

CASE 19. Oscar R., aged 28; ball valve calculus in pelvis of kidney (left); right kidney, 19 m.; dark blue; left kidney, 30 m.; nil. Nephrolithotomy. *Recovery.* Calculus measured about 1.5 cm. in diameter.

PYELITIS

CASE 20. Robert H. N., aged 21; pyelitis; acute cystitis; right kidney, 17 m.; dark blue; left kidney, 15 m.; dark blue. Urinary antiseptics. *Recovery.*

CASE 21. Benjamin K., aged 60; Bilateral pyelitis; chronic cystitis; prostatic hypertrophy; right kidney, 30 m.; nil; left kidney, 18 m.; light blue. Bacterin therapy and urinary antiseptics.

PYELONEPHRITIS

CASE 22. Bella G., aged 38; suppurative pyelonephritis; right kidney, 9 m.; dark blue; left kidney, 20 m.; nil. Nephrectomy. *Recovery.* Cortex of removed diseased kidney thinned almost beyond recognition. A few compressed atrophied tubules were visible.

PYONEPHROSIS

CASE 23. Patk. T. W., aged 24; pyonephrosis; atrophy; fatty and fibrous degeneration; right kidney, 15 m.; dark blue; left kidney, 30 m.; nil. Nephrectomy. *Recovery.* Practically the entire organ had degenerated into fatty and fibrous tissue.

CASE 24. Lizzie L., aged 29; pyonephrosis; acute cystitis; right kidney, 30 m.; nil; left kidney, 10 m.; dark blue. Nephroureterectomy. *Recovery.* Has since given birth to another child. One half of organ involved in nut-sized are as of suppuration.

CASE 25. Agnes L., aged 30; pyonephrosis; acute cystitis; right kidney, 30 m.; nil; left kidney, 12 m.; dark blue. Nephrotomy, nephrectomy being impossible on account of size of diseased organ and adhesions. Death from peritonitis.

CASE 26. Mrs. D. O., aged 31; pyonephrosis; complete occlusion of left ureter; right kidney, 7 m.; dark blue; left kidney, 20 m.; nil. Nephrectomy. *Recovery.* Entire parenchyma was supplanted by a sac of pus.

REN MOBILIS

CASE 27. Katie J., aged 35; mobility and palpability of left kidney; right kidney, 7 m.; dark blue; left kidney, 8 m.; dark blue. Typical symptoms of movable kidney of mild grade. Clear urine and normal bladder. Palliative treatment by pad and abdominal support.

RETENTION OF URINE

CASE 28. Jacob T., aged 54; Carcinoma of prostate; chronic cystitis; trabecular hypertrophy of bladder; vis a tergo pressure upon the kidneys by urine; right kidney, 30 m.; light blue; left kidney, 30 m.; light blue. Declined operation, which in view of the character of the elimination of indigo seemed contraindicated.

CASE 29. Caspar M., aged 70; carcinoma of prostate; trabecular hypertrophy of bladder; vis a tergo pressure upon the kidneys by urine; right kidney, 30 m.; nil; left kidney, 30 m.; nil. Refused operation, which apparently was contraindicated by the character of the indigo elimination.

CASE 30. Harry D., aged 66; prostatic hypertrophy; vesical calculi; trabecular hypertrophy; chronic cystitis; right kidney, 30 m.; nil; left kidney, 30 m.; nil. Litholapaxy under local vesical anæsthesia.

TUBERCULOSIS

CASE 31. Mary H., aged 39; tuberculosis of right kidney; cystitis; right kidney, 30 m.; light blue; left kidney, 12 m.; dark blue. Nephroureterectomy. Kidney contained four cavities ½ x 2 cm. in diam. Caseous foci were present elsewhere in parenchyma. Approximately one-third of organ diseased. Tubercles impregnated pelvis. Ureter greatly thickened. *Recovery.*

CASE 32. Herman R., aged 24; tuberculosis of right kidney with occlusion of ureter; tuberculous cystitis; right kidney, 30 m.; nil; left kidney, 20 m.; dark blue. Patient very ill with a hectic temp. Retroperitoneal suppuration with sinuses. Expectant treatment.

CASE 33. John D., aged 38; tuberculosis of right kidney and ureter; tuberculous ulcerative cystitis;

right kidney, 60 m.; nil; left kidney, 16 m.; light blue. Palliative treatment. Pus was emptied copiously from right ureteral orifice into bladder. Three weeks after examination an acid fast bacillus was found.

CASE 34. Joseph McC., aged 35; bilateral tuberculous nephritis secondary to pulmonary lesions; perinephric abscess (left); right kidney, 21 m.; light blue; left kidney, 27 m.; light blue. Simple evacuation of perinephric abscess. Nephrotomy or nephrectomy contraindicated.

TUMORS

CASE 35. Bessie I., aged 18; papilloma, ulcerative (left); right kidney, 8 m.; dark blue; left kidney, 20 m.; nil. Nephrectomy on account of marked and increasing hematuria. Small ulcerated papilloma protruded into renal pelvis. Cystoscope demonstrated free bleeding from left ureter. *Recovery.*

CASE 36. Tillie F., aged 38; tumor, ulcerative (right). Hydronephrosis (left); right kidney, 18 m.; dark blue; left kidney, 18 m.; light blue. Free bleeding from right ureter, later mixed with blue, clear urine gushed from left ureter only after 18 minutes. Still under observation.

URETERAL CALCULUS

CASE 37. Benjamin N., aged 35; calculus of right ureter; right kidney, 20 m.; nil; left kidney, 8 m.; dark blue. Ureteral catheter obstructed 12 cm. from ureteral orifice. Referred for X-ray.

CASE 38. Jesse S., aged 29; calculus of right ureter; cystitis coli; right kidney, 6½ m.; dark blue; left kidney, 30 m.; nil. X-ray subsequently showed a shadow on left side just below pelvic brim. Ureterolithotomy. *Recovery.*

CASE 39. Edgar S., aged 28; calculus of right ureter; very small; uric acid vesical calculi; right kidney, 20 m.; nil; left kidney, 6 m.; dark blue. Ureteral catheter obstructed 10 cm. from ureteral orifice on right side. X-ray subsequently confirmed diagnosis. Ureterolithotomy. *Recovery.*

URETERAL STENOSIS

CASE 40. James T., aged 50; stenosis of left ureter; chronic cystitis; trabecular hypertrophy of bladder; right kidney, 7 m.; dark blue; left kidney, 30 m.; light blue. Refused ureteral dilatation. Discharged.

All cases, 70 in number, subjected to the indigocarmin test[1] during the past four years have been collected in two general classes: "Cases with Normal Kidneys" and "Cases with Diseased Kidneys." The classification has been made directly with respect to the time and intensity of the elimination of indigocarmin, and governed as far as possible by the cystoscopic findings and the subsequent history of the patient and course of the disease. Based upon such a study, 29 patients, chromoureteroscoped for vague urological symptoms, but believed undoubtedly to have functionally sufficient kidneys, have been placed in the first report. From these cases and those of unilateral disease in the second report, indigocarmin demonstrated normal kidney 98 times. Although the exact time limit for normal kidneys has probably not yet been definitely determined, my experience has indicated that in the event of the excretion of the indigo as a dark blue, it should be placed, for the present at least, at 20 minutes, while if the elimination occurs as a light blue, 15 minutes should be the time. The onset of the excretion of the dye as a light blue after 15 minutes and continuing as such, probably indicates functional degeneration of the respective kidney. The earliest appearance as dark blue occurred in 4½ minutes, the case being one of renal calculus, no elimination taking place from the affected side for 30 minutes. In 86.7 per cent of kidneys considered functionally sufficient, the indigocarmin was excreted as either a dark or light blue in 4½ to 15 minutes. As a general rule the dye makes its appearance in individuals with normal kidneys at the same time on both sides (75 per cent of cases). Where there has been a variance, it has ranged from 1 to 7 minutes.

A review of the second report, wherein are given 41 cases with diseased kidneys, demonstrates nephrotomies and nephrectomies 20 times with 19 recoveries; the single death occurred as the result of peritonitis. The prognosis as to the sufficiency of the supposedly normal sister organ, in view of operative interference, is not the least important concern of the surgeon. The results in these 20 cases are assuredly a fitting tribute to indigocarmin.

It will be observed in both reports, that in 13 cases the excretion of the dye as a light blue occurred from 18 kidneys; 6 times before 15 minutes (twice in mild prostatic hypertrophy and 4 times in chronic parenchymentous nephritis); 12 times after 15 to 30 minutes (once in chronic interstitial nephritis,

[1] In my early work, 4 cc. of a 4 per cent solution of indigocarmin were injected intramuscularly into the glutei muscles. During the past two years, 20 cc. of a 0.4 per cent solution were employed. It matters little which amount is used, the latter may be absorbed more quickly and seems no more irritating.

once in pyelonephritis, once in pyelitis, twice in carcinoma of the prostate, once in simple prostatic hypertrophy, four times in tuberculosis, once in anemia, and once in ureteral stenosis). In those cases in which the dye was eliminated as a light blue after 15 minutes, there seemed to be unmistakable evidence of grave functional degeneration of the respective kidney, necessitating the placing of the time limit for sufficiency under these conditions at 15 minutes.

A glance at the report with diseased kidneys will show the diversified affections in which the indigocarmin test was impartially applied. Those conditions in which it appears to be of greatest value are hydronephrosis, moderate to large sized calculi of either the kidney or ureter, pyelonephritis, pyonephrosis, tuberculosis of moderate to extensive degree, involving at least one-third of the parenchyma, ureteral stenosis, and retention of urine due to urethral obstruction, particularly by prostatic enlargement as simple hypertrophy and carcinoma. The conditions in which the test is of little or no value are movable kidney of slight mobility in which there is no kinking of the ureter, nephritis, pyelitis, and tumors not involving a majority of the parenchyma. However, in the last two, the presence of pyuria and especially in the last, in the absence of tuberculosis or calculus or renal papillary varix (essential hematuria) the appearance of free bleeding from the ureter may establish the diagnosis on sight.

For the most part the two reports are self-explanatory and the deductions easy. There are two groups of cases of peculiar interest to which I would especially direct attention:

1. *Retention of urine.* By this I mean chronic not acute retention, the common etiological factor being progressive prostatic enlargement. It would seem that in this condition we have to deal with a vis a tergo pressure by the urine upon the renal parenchyma, causing a degeneration of function, and it has so happened in the cases of simply hypertrophy and carcinoma of the prostate where it has been my fortune to employ the indigocarmin test, that invariably there has been a retardation in the elimination of the indigo or else it was excreted as a light blue. In four of the cases the results of chromoureteroscopy were such as to contraindicate, apparently, operative interference under general anæsthesia. It may be that by this simple test we have a measure whereby we can say which cases of prostatic disease may be and which may not be operated.

2. *Nephritis.* It has been stated that the indigocarmin test is without value in nephritis, although it may serve to differentiate haemorrhagic from other forms of nephritis. Confirmatory of this statement that the indigo is blocked in haemorrhagic nephritis, see case No. 2, second report. On the other hand, that the test is worthless in certain types of the disease is true. In case No. 7 of acute unilateral hematogenous suppurative nephritis, in which at least one-half of the parenchyma was involved in miliary suppurative foci, the indigo was eliminated profusely in 7 minutes and synchronously from both sides. The excretion of the dye with respect to two other types of nephritis, to me has possessed particular interest. Although the cases have been too few for absolute conclusions, it would seem that possibly we possess in indigocarmin a means of diagnosis between chronic parenchymentous and chronic interstitial nephritis. In the only case of chronic interstitial type of disease submitted for the test, there was no excretion of indigo from the right side for at least 30 minutes, while from the left side it appeared as a light blue only after 20 minutes. In the chronic parenchymentous type of the disease the elimination occurred normally. In a comparative study of this character, great caution should be exercised to see that the clinical diagnosis is absolutely correct and, if possible, the case followed to autopsy in an endeavor to learn from a competent pathologist the exact nature of the nephritis. By such studies, which I should be gratified to see undertaken more extensively, we may be able eventually to determine by chromoureteroscopy which of sister kidneys is the more diseased, also to offer a prognosis with respect to the duration of life. Should the differentiation between chronic parenchymentous and chronic interstitial nephritis by this means become practical, we will have taken

a decided step in the determination as to whether the chromogen is eliminated from the glomeruli or the epithelia of the convuluted tubules. If it be true, as seems likely, that in the case of chronic interstitial nephritis the dye is excreted lightly or not at all, and in chronic parenchymentous nephritis within the normal time limit, and if the generally accepted teaching of Heidenhain, to the effect that the epithelia of the convoluted tubules excrete the chromogen, is to live, it must necessarily follow, that diseased epithelium can eliminate the dye as well as the normal. Such a conclusion is utterly irrational and it would seem that Heidenhain's doctrine must explode.

The objections to chromoureteroscopy based upon the employment of indigocarmin have been numerous. Fortunately, year by year, they become fewer and the popularity of the test increases. The remaining pessimists are waging a losing battle, largely because of the absurdity of their contentions. It is not claimed that the indigocarmin test is infallible — what functional kidney test is? There are certain conditions when the test should and must be supplemented by ureteral catheterization, X-ray, etc. It is emphatically claimed, however, that for the purposes of the surgeon, for whom the simplicity of the test recommends itself, chromoureteroscopy will establish the diagnosis and prognosis in at least 90 per cent of cases. So deeply impressed am I with the value of the indigocarmin test, when properly executed, that I have not the slightest hesitancy in predicting that in a given series of cases the chromoureteroscopist will be enabled to make far more correct surgical diagnoses and prognoses, than he who is wont or obliged to depend in all cases upon bilateral synchronous ureteral catheterization.

CONCLUSIONS

1. Chromoureteroscopy based upon the employment of indigocarmin is the most valuable single test for renal sufficiency or insufficiency that we possess, because it is the most practical, affording the same diagnostical advantages as the functional tests dependent upon bilateral synchronous ureteral catheterization, the technique and determination of which are tedious, complicated, and consumptive of much more time.

2. The test is particularly applicable for surgical affections of the kidneys and ureters and almost invariably suffices to establish the diagnosis, if, when the indication arises, it be supplemented by ureteral catheterization.

3. Comparative observations of the *onset* and *intensity* of the color elimination, have never failed to determine the functional sufficiency of the supposedly normal sister organ in view of a nephrotomy or a nephrectomy.

4. It is of no value in movable kidney in the absence of a ureteral kink or hydronephrosis, pyelitis, early tuberculous, and certain other forms of nephritis and small tumors not involving a majority of the parenchyma.

5. It is of value in the differential diagnosis of hæmorrhagic and chronic interstitial nephritis from other types of the disease.

6. Supplemented by ureteral catheterization, and the X-ray, it will serve to diagnose practically every case of renal and ureteral calculus.

7. In hydronephrosis, pyonephrosis, pyelonephritis, and chronic tuberculosis of the kidney involving approximately one-third of the parenchyma, chromoureteroscopy is of exceptional merit.

8. In simple hypertrophy or carcinoma of the prostate, causing chronic retention of the urine, the indigocarmin test promises to be of value in the differentiation of operable and non-operable cases.

9. Chromoureteroscopy is also of great value in the differential diagnosis of obscure abdominal tumors, also in facilitating difficult ureteral catheterization.

10. The duration and quantity of indigo excretion are also of diagnostical importance, but routinely impractical of determination and unnecessary of notation.

11. Indigocarmin is eliminated from normal kidneys as a dark blue in 4½ to 20 minutes; as a light blue, not later than 15 minutes. In 86.7 per cent of normal kidneys it appears either as dark or light blue in 4½ to 15 minutes.

12. If the indigo does not appear at the expiration of 15 or 20 minutes, it is evidence of serious insufficiency of the renal function.

13. If the elimination of the dye does not occur at all, the kidney or ureter is gravely diseased.

14. The intensity of the color reaction (dark blue or light blue) depends upon the concentration of the urine and the individual secretory power of the organ.

15. A surgically diseased kidney eliminates the dye less intensely than its normal sister organ, or not at all.

16. The test is very simple and by alternate observation of the two ureteral orifices, differences between the two kidneys are readily and speedily noted.

Finally, I wish to express my deep appreciation to numerous physicians and surgeons, and especially to Dr. Charles H. Frazier do I feel most grateful for the opportunities afforded to carry out this work.

MALIGNANT PAPILLARY ADENOMA OF THE KIDNEY[1]

With Discussion of a Case

By J. S. EISENSTAEDT, M. D., Chicago, Illinois

THE definition of malignant adenoma has in itself occasioned quite a difference of opinion among pathological anatomists and clinicians. There are generally speaking two distinct appreciations of the term, one, that expressed for instance, by C. Ruge, Winter, and Gebhardt, is very restrictive. They limit the term to a tumor of adenomatous structure, malignant in character, showing throughout a single row of epithelium lining the alveoli and in no way microscopically differing from a simple adenoma. On the other hand, Kaufmann, von Hansemann, and Lubarsch understand by the expression, a tumor of malignant type, glandular in character, showing usually transitional or polymorphous epithelium, sometimes also solid cell aggregations. Their standards of malignancy are the same.

Borst, in regard to malignant adenoma, cites the various organs involved by this variety of neoplasm in the order of frequency.

Intestine and stomach, reported by Selberg.

Liver, von Hansemann.

Gall-bladder, Selberg.

Uterus, cases reported by Livius, Furst, Veit, Kaufmann, C. Eckhardt, Kuckenberg, Eberth, Olshausen, Schröder, Selberg.

Lung (bronchial mucous glands), von Hansemann.

Sweat and salivary glands, von Hansemann.

Borst does *not* report its occurrence in the kidney, *nor* do any of the following authors in their writings on kidney tumors: Krönlein, Mönkeberg, James Israel, Franz Nürnberg, Albarran, and Imbert.

On a careful search of the literature, but one absolutely proven and undoubted case is to be found, namely, that reported by Sudeck in 1892. The cases of renal tumor reported as malignant adenoma have partly been confused with hypernephromata. Von Hansemann says that he has seen examples of this type of new growth in the kidney and cites James Israel's case, as the first one observed. Israel, however, reported this case in 1892 as a hypernephroma. Baumgarten's case reported as "congenital malignant adenoma of the kidney" belongs to that now well studied group of tumors, the congenital adenosarcoma, in which the adenomatous structure was very marked.

On account of the extreme rarity of this variety of neoplasm in the kidney and of the distinct characteristics of the case observed, I have thought it worthy of being placed in the literature. The primary tumor is far more typical in microscopical appearance than Sudeck's case, and by virtue of its widespread metastases much more malignant in type.

CASE REPORT

By courtesy of Dr. Braun, directing surgeon. History: Patient entered Hospital Friedrichshain, Berlin, March 14, 1910. F. R., male, aged 56 years, railroad pensioner. Since September, 1909, complained of frequent hematuria, dragging pain in right renal region without the occurrence of any colic or colicky pains. For three weeks before entrance to the hospital, he had been confined to his bed. The presence of a growing tumor in right renal region was

[1] From the Pathological Institute of the City Hospital, Friedrichshain, Berlin, Germany, Professor Ludwig Pick, Director.

Fig. 1. Right kidney; mfk, show metastasis in fat capsule; fk, involved fat capsule torn away with kidney; nb, dilated renal pelvis.

determined by his house physician and he was sent to the hospital for surgical treatment.

Past illnesses. Acute rheumatic fever, gout. Venereal disease denied. No history of alcohol abuse.

Present condition. Examination. Middle sized man, of average muscular development in poor state of nutrition. Skin pale and of cachetic appearance. Supra and infra clavicular as well as intercostal spaces sunken. Mentality, patient dejected.

Thorax. Heart negative to inspection, percussion, and palpation. Systolic murmur at apex, not transmitted. General arteriosclerosis. Lungs give increased breath sounds over entire area, but nowhere true bronchial breathing.

Abdomen. Normal in contour and somewhat rigid. Skin transparent, veins prominent. In right kidney region, a tumor mass is noted, which is slightly movable, hard in consistency and with nodular surface. This mass is not especially tender on pressure and reaches to within a finger's breadth of the umbilicus. The liver dullness can readily be distinguished from the tumor dullness, the two areas being separated by about 2 cm. of modified tympany. Inguinal glands enlarged.

Urine. Albumin in large quantity. Sediment shows few hyalin casts, and a few red and white blood corpuscles. No tumor cells found.

Clinical diagnosis. Tumor of right kidney.

Operation, March 16, 1910. Morphine, chloroform and ether narcosis. Incision in right lumbar region. Kidney exposed and found to be wholly involved by large hard tumor mass, and about three times as large as a man's fist.

The kidney was freed with great difficulty and in order to do so a portion of the twelfth rib was resected. The upper part of the tumor mass projected under the liver and here also involved the parietal peritoneum. This was necessarily removed with the kidney. The removal of the entire tumor mass was found impossible on account of the great involvement of surrounding structures. The kidney and part of fat capsule only were removed. The pelvis and ureter were enormously dilated and yielded on puncture a turbid urine. The usual surgical technique of removal of kidney was followed. The patient ran a subnormal temperature during entire time in the hospital, it never reaching above 36 degrees centigrade after the operation. Death followed three and a half days after operation.

Autopsy, March 20, 1910. Medium sized emaciated male cadaver, rigor mortis present. Slight postmortem lividity on posterior surface. In right lumbar region is a recent operative wound 20 centimeters long; partly closed by suture, in the upper and open part there are six blood stained gauze strips leading to a cavity, the size of newly born child's head. Right kidney wanting.

Thorax. Heart normal in size, myocardium flabby and of pale yellowish brown color. Epicardium contains somewhat less than the normal amount of fat. Valves intact, and competent to water test. Aorta and coronary arteries show slight arteriosclerosis.

Lungs. Bilateral pleural adhesions. Lungs contain much bloody fluid. Both show several white soft nodules, varying in size from a pinhead to a large pea. Bronchial glands anthracotic, but show no tumor nodules. Bronchial and tracheal mucosa, injected.

Diaphragm. In right half of diaphragm are several flat lentil sized tumor metastases of same appearance as those noted in the lungs.

Abdomen. Spleen showed well marked perisplenic adhesions, but no tumor metastases. Urinary bladder, mucosa injected. Prostate, negative. Rectum, mucosa injected.

Stomach and intestines. Mucosa slightly hypertrophic and of yellowish green color, partly covered with tenacious mucous.

Liver. Small in size, capsule adherent in places to parietal peritoneum. The organ contains many spherical tumor nodules, varying in size from a pinhead to a cherry; similar in appearance to the lung metastases, they are *not* umbilicated.

Gall-bladder. Negative.

Pancreas. The pancreas itself showed no changes, but the glands about its head are very large and show tumor metastases of the same appearance as those observed in the lungs and diaphragm.

Mesenteric glands. Greatly enlarged and markedly softened. On section most are of the same color as the tumor nodules.

The left kidney. The left kidney is enlarged and somewhat harder than normal. Capsule removed with slight difficulty. The cortex is reduced in diameter, but markings are distinct. No tumor nodules grossly recognizable.

Left ureter. Negative.

The abdominal aorta. Shows slight degree of arteriosclerosis. The exit of right renal artery is almost wholly obliterated, but does not contain tumor mass. Left renal artery, normal.

Vena cava inferior. This vessel is almost entirely surrounded by tumor growth and from its origin to within two centimeters of diaphragm contains a necrotic tumor thrombus mass. Cross section through this adherent conglomeration of tissue shows the tumor involvement affecting the region chiefly to the right of the vena cava, and the greatly thickened vessel walls partly destroyed by tumor invasion. The tissues to the left of the vena cava are not so markedly involved and the individual periaortic glands can be distinguished. These on section show tumor

nodules of the same appearance as those noted in lung, diaphragm, and glands about head of pancreas.

Right renal vein. Shows the same changes as described for vena cava. The entrance of the left renal vein is thrombosed by tumor invasion, the remainder is free.

Right iliopsoas muscle. Shows several tumor nodules.

Brain. Section forbidden.

Bony system. Section forbidden.

Anatomical diagnosis. Malignant tumor of kidney (right) with metastases in following organs: Liver, lung, diaphragm, right iliopsoas muscle, periaortic glands, mesenteric glands and lymphatics about head of pancreas, tumor thrombi of both renal veins, tumor thrombosis of inferior vena cava.

Arteriosclerosis of aorta and coronary arteries, bilateral pleural adhesions, hyperemia and edema of lungs, perisplenic adhesions, chronic interstitial nephritis, cystitis, chronic gastritis, and enteritis.

Gross pathology of right kidney. The entire organ is involved by new growth and no trace of renal tissue is grossly recognizable. It measures 18 cm. in length, from 6 cm. to 9.5 cm. in breadth and from 4 cm. to 5.5 cm. in thickness.

The color varies from yellowish gray to yellowish brown and here and there hæmorrhagic areas are noted. These measure from about 1 to 4 cm. in diameter and are irregular in contour, and are not confined to the boundaries of the individual nodules involved.

The whole kidney is made up of numerous tumor nodules, varying in size from a pea to an English walnut, and the surface is extremely irregular. The different nodules are separated by a firm, but very scant connective tissue. The true fibrous capsule is in places wanting, but when one tries to remove the remainder, tumor mass is torn away with it. A large area of necrosis, about the size of small hen's egg, is noted in lower pole. No suggestion of cyst formation is present.

Section through kidney. Cut section of kidney shows but few additional points of interest, the total involvement of tumor; the nodular structure and hæmorrhagic areas are all more distinctly seen than on surface.

Microscopic examination of tumor. Preparations made from diverse parts of primary tumor and of all tissues involved were hardened in formalin and alcohol, embedded in paraffin and cut in thicknesses from 5 to 10 microns and stained by hæmalaun-eosin. Fresh frozen sections were also made and stained for elastic fibers after Weigert and for fat with Nile blue and Sudan III.

Low power. No. 3 obj., No. 2 eyepiece (Leitz). All sections of primary tumor examined show identical structure, namely, a papillary new growth of distinct adenomatous type. Each microscopic nodule is seen to be made up of numerous cavities, surrounded by a small amount of fine connective tissue, poor in nuclei. These cavities contain numerous papillary proliferations of various sizes. Many of the larger ones show branching and secondary papillary excrescences. Some are long and narrow, others short and broad. They are made up of a fine fibrous stroma which supports an abundant blood supply and are clothed with a single layer of epithelium. Bleeding into the stroma of some of the papillæ can be noted, others are edematous.

No renal tissue is to be found in sections made from various parts of the organ.

High power. $\frac{1}{6}$ obj., No. 2 eyepiece. More minute study of the various preparations shows the papillæ to be made up of a fine connective tissue stroma, small in amount, the nuclei of which stain well with hæmalaun, and are somewhat shorter and broader than is the rule. Many capillaries are to be seen, some of which are greatly

Fig. 2. Section of primary tumor (high power); e, single layer of columnar epithelium; str, connective tissue stroma of papilla; w, internodular septum.

dilated. The other blood-vessels show no peculiarities. An almost regular epithelium, chiefly of the tall cylindrical type in single layer covers the papillæ.

The epithelial cells present a well staining (eosin) homogeneous protoplasm and relatively large oval nuclei which stain well with hæmalaun.

The nuclei are *vacuolar* and present nucleoli, sometimes as many as three in one nucleus. They are usually located near the base of the cell, but not infrequently quite near the middle.

In one or two sections the epithelium appears to be in two or three rows, but this was later shown by cutting very thin paraffin sections not to be the case, but *that throughout the epithelium is in single layer.*

Hyalin degeneration is found in various areas; and many of the alveoli are filled with necrotic epithelial and blood cell detritus.

Both Sudan III and Nile blue in frozen sections were used to determine the presence of fatty change in the epithelium, but such is absent.

Small round cell infiltration is found in various areas.

Microscopic examination of the various metastases. Preparations of all metastases examined show the same general picture as described for the primary neoplasm. The papillary structure in the larger and older metastases is exquisitely marked, while in some of the smallest and youngest nodules, one notes merely the tendency thereto, and finds some alevoli lined with two and three layers of epithelium and even solid cell aggregations. The papillary structure is *always* well marked in those metastases, which have advanced far enough in their development to demonstrate the mutual growth and relation of connective tissue and epithelial elements. For example, nearly all the nodules in the lung show absolutely the same structure as the primary tumor, with the cylindrical epithelium in a single layer clothing the papillæ, while some of the metastases in the diaphragm, for example, being but microscopic and very young show the presence of a double or triple epithelial layer lining the alveoli. The

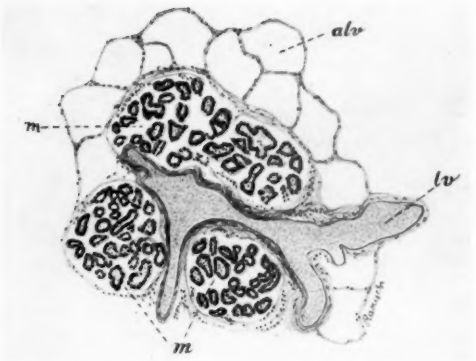

Fig. 3. Section of lung metastasis (low power); lv, branch of pulmonary vein; alv, lung alveolus; mm, metastases occluding lymph spaces about pulmonary vein.

capillaries in these minute nodules are very abundant and often greatly dilated. The blood-vessels in general, are not involved by tumor thrombi, but the lymphatics are frequently distended and obstructed by tumor growth. The metastases in the liver are chiefly necrotic, as are the same noted in the mass about the inferior vena cava.

This tumor then presents certain characteristics of interest. Especially the pure papillary structure of the primary tumor and older metastases with their single layer of epithelium throughout, a picture which we have been taught to regard as typical of certain benign epithelial growths. This neoplasm later giving rise to numerous and widely spread metastases, all showing the papillary tendency and being similar to the primary neoplasm. The variability observed between the smallest and largest metastases seems to depend wholly upon the stage of development.

A small metastatic nodule shows in its incipiency microscopically a minute solid cell aggregation, through which very early newly formed capillaries find their way, making a network throughout the nodule. As the blood gains entrance to the capillaries causing their distension, the appearance of alveoli is given, with certain of the epithelial cells applied directly to the thin capillary walls. Now if even the most minute resistance opposed to the blood by the capillary walls is overcome, as Sabourin says "a veritable cataclysm" occurs, the blood gaining entrance to the adenomatous tissue causes minute hæmorrhagic cysts with coincidental tearing of some of the epithelial cells from their insertion and destruction of others. Somewhat later when the connective tissue grows in about the capillaries and the interdependent or mutual growth of the two elements occurs, we note the appearance of well marked papillæ projecting into the various alveoli.

Benign papillary adenomata of the kidney are by no means common in the literature. Franz Nürnberg, for example, in 287 cases of renal tumors examined, found adenomata in 66 cases, only 37 which showed papillary structure. Von Hansemann calls attention to the fact, that in papillary tumors, if the papillæ have a broad stroma and are clothed with a single layer of a cubical epithelium, a diagnosis of benignancy can be made; but if the reverse be noted an absolute diagnosis of malignancy *can not* be made.

Sudeck, however, found polymorphous epithelium with rather indefinite papillary structure in four cases of small and absolutely benign renal adenomata; and a similar picture in his case of malignant papillary adenoma of the kidney with lung metastases, which microscopically he could not distinguish from the benign adenomata.

This case however, presents well marked and definite papillæ, some short and broad, others long and graceful, all covered with a *single* layer of cylindrical epithelium. It differs markedly from the rule expressed by von Hansemann that in malignant papillary adenomata, the long narrow papillæ greatly predominate, in as much as we note a very large proportion of short thick papillæ.

Nota.—A small nodule of papillary adenomatous type was found on microscopic examination of left kidney, showing a chronic interstitial nephritis. The pure papillary structure in so *small* a nodule suggests that this adenoma is coincidental rather than a metastases of the above described tumor; as it showed in no place but a single layer of *cubical* epithelium.

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CONGENITAL EPULIDES (ODONTOBLASTOMATA)

A Clinical and Pathological Study

By LOUIS G. KAEMPFER, B. S., M. D., New York City, New York

From the Pathological Laboratory of the Beth Israel Hospital, New York City

INTRODUCTION

CONGENITAL epulides are among the rarest of tumors. They differ histologically and genetically, not only from epulides of the adult, but also from every other recognized form of neoplasm. As such, they therefore constitute a definite pathological entity and deserve a place in subsequent classifications of neoplasmata. Despite a fair histological uniformity in the recorded cases, there is, as yet, not even an approximate agreement in regard to their pathogenesis. In consequence of this, these tumors are still nameless, except in the clinicoanatomical sense.

These facts serve to indicate the scope of this study. Summarized, the objects of this paper will therefore be:

1. The description of a new case.
2. The establishment of a pathogenesis according to the recognized criteria, and the incorporation of this type of tumor in its proper place among the blastomata.
3. (a) A review of the previously reported cases, and (b) the views that have been held concerning their pathogenesis.
4. The suggestion of a name in accordance with correct onomatology.

REPORT OF A CASE

The tumor was removed from a newly born female child, a patient of Dr. Neuman, to whom I am indebted for the specimen. The family history is negative. The child was born at full term and well developed. The mass projected from the mouth raising the upper lip against the nose. The tumor was smooth, regular in outline, the size of a walnut, of a bluish red color and bled easily. It was firm in consistency and softer than cartilage.

The mass was attached to the left alveolar process of the upper jaw by a broad pedicle which extended from a point just to the left of the median line to the site of the first molar tooth. The pedicle was ligated, the tumor cut off with scissors, and the hæmorrhage controlled by pressure. The child recovered rapidly and up to the present, six months after birth, is well.

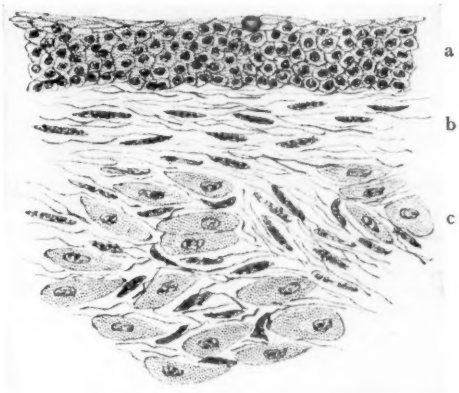

Fig. 1. Peripheral portion. a, Epithelium, mucous membrane of mouth; b, Connective tissue capsule; c, Tumor cells.

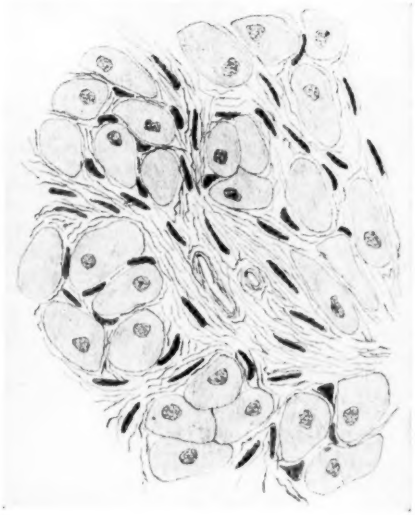

Fig. 2. Central portion.

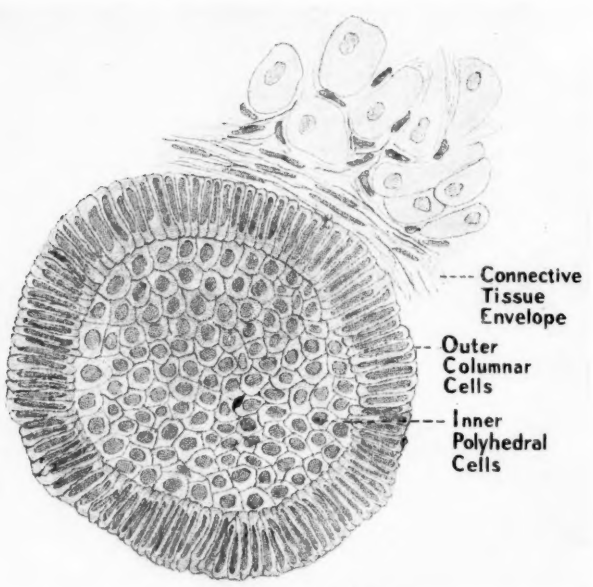

Fig. 3. Epithelial inclusion.

Histology. The tumor was hardened in formalin and then in graded alcohols and embedded in celloidin. Sections from different parts of the growth were stained with hematoxylineosin, polychromemethylene blue, Van Gieson's and Mallory's connective tissue stains and Weigert's elastic tissue stain.

1. Externally there is a layer of stratified epithelium identical in appearance with that of the mouth. The epithelium invests the free portion of the growth but does not seem to have any connection with the deeper layers.

2. Under the mucous membrane there is a layer of dense connective tissue containing relatively few long spindle shaped connective tissue cells. This layer varies in thickness in different parts, but averages that of the overlying mucous membrane. It is distinctly differentiated from the overlying epithelium and forms a complete capsule around the tumor.

3. Broad bands of connective tissue are given off from the capsule at irregular intervals. These extend from the periphery towards the center of the tumor, dividing it into compartments of varying size and shape. These trabeculæ give rise to smaller bands of fibrous tissue which subdivide the tumor into smaller compartments. This arrangement pertains in the peripheral portions of the tumor. Toward the center the larger bands of connective tissue are absent and there is simply a fine stroma of connective tissue surrounding the cellular parenchyma. There are a moderate number of elastic fibers in the stroma.

4. In the fibrous stroma capillaries and small blood-vessels are to be found. Their walls consist of a thick layer of fine connective tissue which contains elastic fibers. A thickening of the intima or a transition between the lining of the blood-vessels and the parenchyma of the tumor could nowhere be demonstrated.

5. The parenchyma of the growth is made up of large cells of different shapes lying in small groups within the spaces of the connective tissue stroma. Toward the center of the tumor these cells are oval in outline, nearer the periphery, where the connective tissue bands are larger and firmer, they are longer and narrower. This variation in the shape of the cells is apparently due to differences in pressure and gives the growth the appearance of being divided into layers. In all places they differ in size, contour, and staining reactions from the cells of the connective tissue stroma.

In most parts of the tumor the cells are arranged in smaller or larger groups surrounded by bands of connective tissue. These cells lie, apparently, in close proximity without the intervention of intercellular substance. Occasionally, however, very fine connective tissue fibers may be seen in the spaces between the cells (see Fig. 2).

In the hematoxylineosin preparation the cell bodies stain very faintly and are finely granular in appearance.

The nuclei are comparatively small, irregular in outline, and usually eccentric. They stain less deeply than the nuclei of the connective tissue stroma or of the epithelial rests to be described.

With the Van Gieson stain the parenchyma cells

stain yellow and with the Mallory stain they take a deep blue color notably different from the purple of the epithelium.

6. In some of the sections epithelial masses can be seen. These masses are surrounded by a narrow layer of connective tissue which forms, as it were, a capsule. Lying against this capsule is a layer of narrow cylindrical cells with deeply staining narrow elliptical nuclei. Within this layer there is a mass of polyhedral cells with round or oval deeply staining nuclei. There is no intercellular substance (see Fig. 3).

With the Mallory stain these cells assume the same deep purple color as the squamous epithelium of the surface.

7. Proceeding from the pedicle of the tumor toward the periphery is an epithelial structure which forms, as it were, the core of the tumor. This structure, on section, is triangular in outline with the base extending outward, its greatest diameter being approximately one-sixteenth that of the tumor. The apex of the triangle is irregular and broken and corresponds to the site of the ligature.

At the periphery there is a layer of long, narrow, cylindrical cells with central, elliptical nuclei. Within this layer of cells there are several layers of shorter, more cuboidal cells with rounder, broader nuclei. The cells of the innermost portion are polyhedral.

This structure is invested by a layer of connective tissue which is intimately connected with the stroma of the tumor.

The epithelial portions of the growth (this structure and the epithelial inclusions described above) differ essentially from the rest of the tumor in their reactions to stains. With the hematoxylineosin stain the cell bodies appear smoother and stain more deeply than do those of the main portion of the tumor. With the Mallory stain the cells stain purple. The nuclei are regular in outline, stain a deeper blue, and occupy more of the cell body. The cells lie close to one another without the intervention of any connective tissue.

THE ESTABLISHMENT OF A PATHOGENESIS IN ACCORDANCE WITH THE RECOGNIZED HISTOLOGICAL AND GENETIC CRITERIA

It is manifest from the foregoing description that this tumor does not correspond in structure to any of the classical tumors.

In the first place, it may be said with little question that the main body of the tumor is of connective tissue origin. The facts which indicate this origin are the following: (a) The intimate relation of the cells to the connective tissue stroma; (b) with differential stains the cells take the connective tissue stains.

On the other hand, the central corelike structure is undoubtedly of epithelial origin. This is evident (a) by the absence of intercellular substance, (b) by the character of the cells which are larger, smoother, and possess relatively larger nuclei, (c) their regular arrangement, corresponding clearly to that of epithelium, and (d) with differential stains the cells take the stain of epithelium.

Predicating the main bulk of the tumor as of connective tissue type, the problem remains to trace its origin. It is manifest that none of the connective tissue constituents of the jaw proper, i. e., submucosa, periosteum or bone, could give rise to a tumor of the histological character that we have described. The situation of the tumor, its attachment to the dental margin of the gums, and its hardness would suggest that the tumor might be of dental origin. Corroboration of this surmise is found in the microscopic identity of our tumor with that of the papilla, and especially of the odontoblastic layer of the developing tooth.

Before proceeding further into an exposition of the histogenesis of this growth, it is necessary to go back for a moment to the embryology of the tooth.

The first indication of the development of tooth structure is, at about the seventh week of fœtal life, a heaping up of the epithelium covering the embryonic jaws to form a ridge along its summit. From this ridge a process of epithelium sinks into the underlying mesoblast when, meeting apparently with some resistance, it spreads into a flattened band, the common enamel germ. From the inner or buccal edge of this band, cordlike processes of epithelium bud and sinking deeper into the mesoblast become the enamel germs of the teeth.

At a point near the end of this process there is a flasklike expansion which becomes the enamel organ of the deciduous tooth. The portion of the enamel germ proximal to the enamel organ of the deciduous tooth is called the neck of the enamel organ. The latter, as well as the common enamel germ, disappear leaving behind epithelial rests, the "debris epitheliaux paradentaires" of Malassez.

The portion of the enamel germ distal to the enamel organ of the deciduous tooth grows deeper into the mesoderm and gives off in turn the enamel organ of the permanent tooth and that of a rudimentary third dentition. The necks of these enamel organs eventually become rudimentary and persist as epithelial rests, similar to those already mentioned.

Coincident with this process there is a heaping up of the cells of the underlying mesoblast to form

cones, the apices of which fit approximately into depressions on the under surface of the enamel organs. These cones are the papillæ of the teeth. At the same time islets of bone are forming to become the alveolar process of the jaw.

The enamel organ now becomes differentiated into an inner layer of narrow columnar cells, the inner enamel layer, which closely invests the outgrowing papilla, and an outer layer of cuboidal cells, the outer enamel layer. Between these two layers is a mass of epithelium forming the so-called stellate reticulum. Meanwhile the outer layer of the papilla becomes differentiated into a layer of high columnar cells, the odontoblasts from which the dentine of the tooth is formed.

The further development of the tooth does not concern us here.

Microscopic study of the papilla of the developing tooth reveals a morphology very similar to that of the main bulk of our tumor. The papilla consists of round or polyhedral cells separated from one another by strands of connective tissue. As we proceed from the central portions of the papilla to the periphery, the cells grow larger as the connective tissue correspondingly diminishes, until at the extreme periphery where we meet with the odontoblastic layer the cells are large, long, contain a large nucleus, while the connective tissue is reduced to the finest strands between the adjacent cells. Small blood-vessels and capillaries are present throughout. An accurate representation of this structure is shown in the plates accompanying Hoehl's studies on the histology of the developing tooth. A glance at these reproductions reveals how closely the structure of our tumor simulates that of the developing papilla, and especially of the odontoblastic layer. The only point in which the two differ in any respect is in the shape of the cells. While the cells of the odontoblastic layer are long and tend to be spindle shaped, those of the tumor are more ovoid or elliptical in outline. When it is considered, however, that the cells of all tumors never simulate exactly their genetic predecessors, due in large part to an inherent aberrancy and a freer growth, this difference becomes negative.

With the dental origin of the tumor established, the nature and origin of the epithelial inclusions immediately become clear. It is evident that these inclusions can be justly regarded as remains of the enamel organ.

A summary of the pathogenesis would lead us to say, therefore, that the tumor is of connective tissue origin arising from the mesoblastic process which enters into the formation of the tooth, and that, in the aberrant growth of this tissue, it includes within it portions of the enamel organ.

To place our growth in its proper place among the tumors of the jaw of dental origin, it is necessary to review the classification of these growths according to the latest authorities.

Kaufman classifies these growths as follows:

1. *Adamantinoma.* "Schmelztropfen." Tumors arising from the enamel organ, and therefore of epithelial origin. They are very hard, usually have an alveolar structure and their interstitial tissue is reduced to a minimum. They are found in adults.

2. *Odontoma*, composed of dentine and pulp with odontoblasts. They are overgrowths of the tooth germ and grow from an existing tooth. They may be soft at first; later they resemble myxoma, or fibroma. They may contain enamel and bone. [There is a form of odontoma called by Schmidt "embryo plastic odontoma," which he claims arises in that period of development when the tooth papilla is composed of undifferentiated connective tissue. It is a soft connective tissue tumor which grows into the interior of the jaw bone and contains lime deposits and perhaps epithelial strings from the enamel.]

3. *Odontoblastoma.* Congenital epulides; in which the connective tissue elements of the developing tooth play the predominant rôle, while the epithelial are subordinate.

PREVIOUSLY REPORTED CASES

The fullest collection of the previously reported cases of congenital epulides is given by Perthes, who reports seven cases. To this I have been able to add two, one of doubtful validity. There are, therefore, but eight undoubted cases of congenital epulides, including my own.

CASE 1. Neuman observed, in November, 1869, in a well developed full term child (sex not mentioned), two tumors on the upper jaw. They were situated to the left of the median line and were small, one the size of a pea, the other of a bean. They sprang from one thin pedicle.

The tumors were soft, elastic, and red in color. Their surface was smooth. On cut section they were succulent and pale rose in color.

Microscopical examination. Externally there is a thick layer of striated epithelium, under this a layer of connective tissue which merges gradually without line of demarcation into the tumor. The bulk of the tumor consists of large cells with large

nuclei in a stroma containing small round cells. There are many small blood-vessels.

CASE 2. Massin, 1893. A full term normal female child in whom at birth two small tumors were noted arising from the upper jaw at the site of the left incisor teeth. One was as big as a Turkish bean, the other the size of a cherry. Four days after birth the growths were removed.

The tumors were firm, of a pale red color, and presented the appearance of fibromata. They were covered by mucous membrane, continuous with that of the mouth, and were divided into regular sections by bands of connective tissue, giving them a papillary appearance.

Microscopical examination. The epithelial covering was separated from the general structure of the tumor by a layer of connective tissue containing round and spindle cells in small number, with strongly staining nuclei, and small blood-vessels.

The stroma was made up of epithelial elements, arranged in layers, spindle shaped and irregular, with irregular, eccentric nuclei. Between the individual cells were connective tissue bands, barely perceptible in places. The center of the tumor was composed of mucous tissue. Some of the larger vessels contained thrombi. In places there were collections of lymphoid cells embedded in a fine network of connective tissue.

CASE 3. Olivier. In 1893 removed three small tumors from the anterior portion of the alveolar process of a newborn child. (The sex is not mentioned.) The tumors were small, about the size of cherry pits or a trifle larger, and were of a pale rose color. They were covered with normal gingival mucous membrane which had no connection with the interior of the growth.

Microscopical examination. Beneath the mucous membrane was a fibrous capsule containing blood-vessels with narrow lumina.

The body of the tumor was divided into three regions, a peripheral, a middle, and a central zone.

The peripheral zone has the most uniform structure. It is made up of large, irregular cells, resembling at first glance epithelial cells. There are no intercellular bridges. Interstitial tissue is very scanty. Vessels and fine fibers divide the cells into groups of irregular shapes and varying size. The cell bodies are granular and stain differently from the Malpighian cells of the overlying mucosa. The nuclei stain well, are central, ovoid, and contain one or two nucleoli. Some cells contain several nuclei, and kariokinetic figures are visible. There are many blood-vessels of fine caliber.

In the middle zone the cells are irregular in size and shape and arranged in strings. There are giant cells to be seen. This region is quite vascular.

In the central zone the cells are small with relatively larger nuclei and less protoplasm.

The differences in these three zones are probably due to variations in pressure in the growth.

CASE 4. Schorr. 1903. Normal, full term, female child. A sessile tumor arising from the mucous membrane of the lower jaw was noticed at birth. The tumor projected from between the lips and interfered with nursing. Removal on the fourteenth day. Up to the time of its removal the tumor grew a little. It was smooth, firm, pale red in color, and covered by mucous membrane.

Microscopical examination. The growth presented a stroma of connective tissue which divided it into irregular spaces filled with large, polyhedral or longer and more spindle shaped cells containing eccentric nuclei. There were many polynuclear cells. The capillaries in places were thickened by a proliferation of the endothelium. In places the endothelium seemed to have broken through the walls and to have merged with the tumor cells. The center of the growth contains embryonal tissue. Scattered through the tumor are small groups of epithelial cells.

CASE 5. Schorr. 1894. A tumor, said to have been present from birth, was removed from the mouth of an infant between three and four months of age. It rose from the upper jaw at the site of the incisor teeth. It was smooth, measured 2.5 cm. by 3 mm., and was thicker at the apex than at the base.

Microscopical examination. The tumor was covered by stratified squamous epithelium resembling the normal mucous membrane of the mouth. The epithelium dipped down between processes of the underlying connective tissue. These were large polyhedral cells with eccentric nuclei divided into groups by connective tissue fibers. The central portion of the tumor consisted of connective tissue fibers with few cells. There were structures present resembling mucous glands, composed of cylindrical epithelium, and surrounded by smooth muscle fibers.

CASE 6. Givel. 1896. Full term, well formed girl. A tumor the size of the end of the little finger, elastic in consistency, was noticed projecting from the child's mouth. It was behind the lower lip, a little to the right of the median line, and was divided into two parts. The tumor was regular in outline and cylindrical in shape. At its free end there was a deep violet spot resembling an angioma. The remainder of the growth was the color of the buccal mucous membrane.

Microscopical examination. The tumor is covered by the mucous membrane of the mouth. It is very vascular and the endothelial cells of the blood-vessels appear normal. The interstitial tissue is composed of long fusiform cells with large nuclei. In places small round cells may be seen resembling cells of inflammation. In these areas the vessels are more abundant.

CASE 7. Füth. 1904. Normal, female child. At birth a tumor of the upper jaw was noticed at the site of the left incisor teeth. The tumor was covered by the epithelium of the mouth, which sent processes into the depths of the tumor. The growth consisted of large polyhedral cells arranged in strings. The strings of cells were separated from each other

	Sex	Site	Number	Size	Base	Dentition	Author's Diagnosis	Epithelial Rests
Neuman		Upper L. incisor	2 on 1 stalk	Pea Bean	Pedunculate	?	Myeloid sarcoma	o
Massin	♀	Upper incisor	2	Bean Cherry	?	?	Epithelioma	o
Give	♀	Lower R. incisor	1	End of little finger	?	Both dentitions normal	Granuloma or sarcoma	o
Olivier		Ant. portion alveolar process	3	Cherry pits	?	All teeth erupted and normal	Endothelioma	o
Schorr	♀	Lower	1	?	Sessile		Malformation of enamel organ and overgrowth of papilla	†
Schorr		Upper incisor	1	2.5 cm. x 3 mm.	Pedunculate		do.	†
Füth	♀	Up. L. inc.	1	?	?	1° dentition, both teeth deformed	Perithelioma	†
Gore		L. R. inc.	2	Filled mouth	?.		Congenital epulis	o
Kaempfer	♀	U. L. inc.	1	Walnut	Sessile	No teeth at site of tumor at 6 months	Odontoblastoma	†

by bands of connective tissue. The author could trace no connection between the lining of the blood-vessels and the parenchyma of the tumor. The center of the growth was made up of embryonal connective tissue, relatively few fine fibers, and many cells. Scattered throughout the tumor were nests of epithelial cells.

Two years later the patient was observed. All her teeth were sound except the two left upper incisors. The median tooth was a small dirty brown stump, the lateral one was also deformed, small, and discolored.

CASE 8. Another case resembling these cases clinically was reported by Major Gore, Surgeon in the British Army. Unfortunately, his report did not include the microscopical findings, so the case is of little value for purposes of study.

A bluish red tumor which projected between the lips was noted at birth. It arose from the lower gum to the right of the median line and prevented nursing. It was tied off with silk and came away after two days. There was a second smaller tumor to the right of the first.

Clinically these tumors present a picture sufficiently characteristic to insure an easy diagnosis. They are congenital and situated in the region of the incisor teeth. Usually these tumors protrude from the mouth and interfere with nursing. Five of these occurred in the upper jaw, three in the lower, and in one the site was not definitely mentioned. In all the cases in which sex has been reported the tumors occurred in females. The growths are small, hard, smooth and covered by the gingival mucous membrane. Usually there is but one tumor (in Massin's case there were two and in Olivier's three. In Gore's case, there were two). In one instance (Neuman) there were two tumors hanging from one stalk.

All of the tumors were very readily extirpated, without much hæmorrhage, and all the children were able to nurse in a very few hours. In no case, insofar as the authors were able to follow the subsequent course, has there been a recurrence.

RELATION TO SUBSEQUENT DENTITION

Assuming that these growths arise from the dental papilla, it is logical to expect that the subsequent dentition of those teeth which correspond in site to that of the tumor, might be interfered with.

Unfortunately, observations with this end in view, are reported in only three instances. In Füth's case the two deciduous incisor teeth at the site of the previous tumor showed changes such as we might expect. One was of a dirty brown color and apparently without enamel, the other was misshapen and poorly developed. In Givel's case normal teeth of both dentitions were present at the site of the tumor. In Olivier's case all the teeth of the first dentition erupted normally. The second dentition was not observed.

In my case at the sixth month of age, two

teeth have erupted in the lower jaw. There are none in the upper (the site of the tumor). The patient will be followed, however, and her dentition observed.

It is significant that in no instance did the tooth at the site of the tumor fail to appear. The interference with dentition in one out of four observations is only partially confirmatory of our presumption. The normal dental eruption in the other two cases does not necessarily preclude the papillary origin of these growths. The normal dentition may be explained in a number of ways.

First, from the fact that there never was a complete absence of teeth at the site of the tumor we can argue that all of the papilla is not involved in the tumor formation and that the portion of the papilla giving rise to the tumor is so small as not to interfere with the proper development of the tooth.

Secondly: The tooth may be that of the second, or a well developed tooth of the ordinarily rudimentary third dentition which replaces, by a process of compensation, the tooth which has given rise to the tumor.

Thirdly: The tumor may have arisen from an aberrant papilla (Schorr).

Fourthly: Regeneration of the papilla may have taken place, a phenomenon normally observed in some of the lower animals.

SUMMARY OF MICROSCOPIC PICTURE

There is a stroma of connective tissue thicker toward the periphery than at the center. In some cases this is sufficiently dense to give the appearance of a capsule. The connective tissue divides and subdivides forming ultimately a mesh of small compartments. The center of the tumor is softer than the periphery. This gives the effect of a rough division into layers of different densities. Some of the tumors contain embryonal connective tissue in their central portion.

The blood supply consists mainly of vessels of narrow lumen, and capillaries. The observation of Massin, who describes endothelial proliferation with a breaking through of the wall of the vessel, has not been confirmed by other observers.

The compartments of the stroma are occupied by large polyhedral or fusiform cells containing large, irregular, eccentric nuclei. Each of the ultimate compartments contains a single cell, less frequently two or more.

Epithelial inclusions are described in four of the eight recorded cases, those of Füth, Schorr, and my own. In the descriptions of the remaining cases these inclusions are not mentioned. This may be ascribed either to their absence or to an insufficient orientation of the specimen. Judging from our own experience, in which the epithelial inclusions were found only after repeated sectioning of the specimen, we are inclined to favor the latter view.

THE OPINIONS PREVIOUSLY HELD IN REGARD TO THE PATHOGENESIS OF CONGENITAL EPULIDES

Although the microscopic pictures of all the recorded cases of congenital epulides are fairly uniform, no two observers agree as to the diagnosis. Neuman regarded his case as a myeloid sarcoma, a diagnosis absolutely unjustified by his own description. Givel regarded the growth as a granuloma or sarcoma. Füth makes a diagnosis of perithelioma, a diagnosis suggested by Marchand from a fancied microscopic resemblance of the growth to a tumor of the carotid gland which Marchand had described. From Füth's own description and illustrations the cells have altogether insufficient intimacy with the blood-vessels to warrant this diagnosis.

Massin regarded the tumor as an epithelioma arising from the enamel organ. Even excluding the absence of all conventional microscopic criteria of epithelioma, the clinical attributes would alone exclude such a diagnosis. Olivier does not commit himself definitely to a diagnosis. His conclusions are as follows:

1. Congenital epulides differ essentially from others, fibrous sarcomatous, cancerous, or adamantine.

2. Their specific cells are large and polymorphous, resembling epithelioma (endothelioma?).

3. Their origin cannot be determined but it does not appear to be the enamel organ. Perhaps they are inclusions of the gingival

mucous membrane in the course of the development of the alveolar arch.

Schorr's views are very similar to those held by us. He regards the tumor as an overgrowth of the papilla due to a maldevelopment of the enamel organ; in his eyes, therefore, the tumor is a malformation and not a definite neoplasm. Being a theory, Schorr's supposition cannot be proven or disproved. Personally, we leave the question of malformation open, but hold to the view that the growth is a definite blastoma.

NOMENCLATURE

The type of growth of which congenital epulides consist has not as yet received a name. Inasmuch as the constituent cells are, to our view, derived from the connective tissue elements of the developing papilla of the tooth, we suggest the name "odontoblastoma." We are well aware that the name "odontoblast" in anatomical onomatology has been delegated only to the peripheral layer of cells of the papilla. Inasmuch, however, as these cells are derived from the cells of the papilla and resemble them in every respect except in size and shape, we believe the term justified. The epithelial inclusions we regard as incidental and subordinate; it is therefore unnecessary to include them in the terminology.

CONCLUSIONS

Congenital epulides are tumors of a connective tissue type and constitute a form of neoplasm *sui generis*. They have their origin in the papilla of the developing tooth. In one half of the reported cases epithelial inclusions are described, which are very probably remains of the enamel organ. Clinically, the tumors are usually small, pedunculated and attached at the site of the incisor teeth. They occur in females, interfere with nursing, and after removal do not recur. In one instance subsequent dentition was interfered with, evidenced by a maldevelopment of the teeth at the site of the previous tumor. The name "odontoblastoma" is suggested for this growth.

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INTERMITTENT HYDRARTHROSIS[1]

By V. C. DAVID, M. D., Chicago, Illinois
Associate in Surgery, Rush Medical College

INTERMITTENT hydrarthrosis is an idiopathic hydrops of one or more joints recurring periodically in attacks lasting three to four days and with a course generally extending over a period of several years. The hydrops may be primary without concurrent joint lesions, or symptomatic, in which type the hydrops is superimposed on an existing arthritis.

The history of the condition dates back to 1845, when Perrin reported the first case in medical literature and described its characteristic symptoms. Von Veillard in 1857, Moore and Volkmann in 1867, reported cases, and in 1900 Benda collected 57 cases from the literature, including two of his own. Schlesinger in 1899 and Lineberger in 1901 also wrote exhaustive monographs and reported additional cases. Since Benda's review in 1900 there have been 28 cases reported up to September, 1910, including two of our own, which form the basis of this paper.

Case 1. Herman Schlesinger (1). Dr. V., age 47. Well up to 1894. No hereditary disease, lues, gonorrhœa, nor trauma to the joints. Not nervous. Twenty years ago he had rheumatism of the upper thigh. In November, 1894, 1896, and 1898, he had attacks of hydrops of the left knee, which recurred every ten or eleven days and lasted three days at a time. These attacks would last until March of the following year. In the interval the knee was normal. He had prodromal feelings of uneasiness in the joint and polyuria each year before the onset of an attack. During the last few attacks he has had a feeling of intense heat in the face. He had been treated with numerous therapeutic agents, but arsenic seemed to help him the most, and in the summer of 1902 the usual prodromal symptoms were absent.

Case 2. Herman Schlesinger (1). Woman, age 30. Family history of joint disease. When 12 years old, after a severe wetting, she had an acute swelling of the right knee, which lasted for six months. Two and one-half years later the left knee became affected with periodic hydrops. The interval between attacks has been from twelve to fourteen days, with a duration of the attack for four to five days. During an attack the joint could be moved without pain and she walked without support. During pregnancy and three months postpartum the attacks ceased. Quinine seemed to give her the most relief.

Case 3. Herman Schlesinger (2). Girl, 15 years old. She fell on the left knee and a year later without cause it became swollen, and since then she has had periodical attacks lasting four to five days at a time and recurring every fourteen days. During an attack the knee was uniformly swollen, with slightly reddened skin over it. She had a slight temperature. Potassium iodide and support to the knee was used without marked benefit.

Case 4. Lineberger (3). Male of middle age. Sister had rheumatism. In the winter of 1870 the patient struck his left knee with a stick and suffered so much pain as a result that he took a course of treatment at a resort in 1871. He then developed periodic hydrops lasting three days at a time and at intervals of thirteen days. The greatest swelling was on the first day, when he had pains and interference with function. He tried salicylates and took several "cures." In 1886 he had an intermission of one-half year. After that the knee was aspirated and washed out with carbol water and some relief was obtained. Swelling then started in the right knee with thirteen day intervals. After a course of mud baths and the cure at Karlsbad his attacks ceased spontaneously.

Case 5. Lineberger (3). Twenty year old male. In December, 1899, he had a periodic hydrops of the knee with the exception of a pause from July to September, 1901, when he had only slight swelling. The attack lasted in all five days, with an interval of ten or eleven days between. The right knee became swollen two days after the left knee. During attacks the patient would remain a few days in bed. The left shoulder, right hand, and elbow were slightly swollen, and the arm was so stiff it could not be straightened. X-ray examination of the knees was negative and the clear fluid from the joint was sterile and caused no findings on injection of one cc. into a guinea pig. He was treated with thyroid extract and Bier's congestion with practically no relief.

Case 6. Otto Burchard (4). Woman 45 years of age. Mother had migraine, sister neuralgia, and swelling of skin of head and urticaria, and father died of softening of the brain. At 20, patient had trifacial neuralgia with swelling of the skin. Later she had migraine and numbness of the forearm and hand. At 37, she had asthma. For past twenty-five years she had periodic hydrops of the left knee, which occurred for the first time in the morning when she awoke. This followed a long walk and was at the time of her menstrual period.

[1] From the Surgical Department, Rush Medical College.

In two instances she was without attacks for a period of a few years, and in addition during three pregnancies. Of late she has had fourteen day intervals between the attacks, and the hydrops would come shortly before or after a menstrual period every other time. The attacks have stood in close relation to her asthma. If she has hydrops, the asthma is absent and vice versa. She has had angioneurotic edema of the foot. Psychic influences had no effect on the onset of the hydrops. Prodromal feeling of malaise precedes the attack. She has pain in the joint, but no change in the skin over the joint, and no fever. The attacks last four days. Treatment did not relieve the attacks.

CASE 7. Neufeld (5). Woman, 47 years old, who for past fifteen years has had periodic hydrops in the right knee, and for the past year in the left knee. The interval between attacks was fourteen days and the duration of the attack four days. The ends of the tibia and femur next to the knee presented irregular nodules, and dry crepitus was present over both knees. It was thought that a possible etiological factor of the condition was exposure to the cold.

CASE 8. Chauvet (6). Man, 35 years old, who had syphilis sixteen years ago. Both knees affected, one after the other, with three day hydrops, recurring every nine days. Pain was present along the course of the sciatic nerve. Later he had lumbago, stiffness of the left elbow, and in the calf of the leg.

CASE 9. Brackett and Cotton (7). Man, 30 years old. Four years ago had occasional pain in the hip, thigh, and knee. Later he had periodic swelling in the knees which lasted about four days at a time. The knees were affected alternately with local swelling, heat, and soreness, and the patient suffered from general malaise and marked disability. Guiaquin in 20 grain doses caused a gradual lengthening between attacks and finally their complete cessation.

CASE 10. Brackett and Cotton (7). Woman, 35 years old. First attack followed a slight trauma when the knee was treated by fixation. Periodic attacks every ten days, preceded by malaise and languor, occurred in the knee, which would become tender, swollen, and hot. Attacks lasted four days with the swelling most on the second day.

CASE 11. G. Stradiotti (8). Man, aged 28. At 20, had malaria for which he received quinine therapy. At 21, the quotidian type of fever returned, and again during 1900, 1901, 1903, but was amenable to quinine. In 1901, when recovering from the attacks of malaria, his left knee became enormously swollen without symptoms, and remained so for twenty days. Two years later the same condition prevailed in the right knee and later in the left knee. In 1906, the left knee was again affected. Treatment failed to stop the attacks.

CASE 12. G. Stradiotti. Male, 27 years old. Seven years ago had a painless swelling of right knee, which disappeared in two days. About three months later and in the following year he had four attacks without any known cause. Two years later the swelling again recurred four times within the period of a month and then again three months later. In April, 1906, there were frequent attacks and the left knee also became affected but not simultaneously with the right. The left knee then became affected as before, and in spite of mud baths and various drug therapy, it is in about the same condition.

CASE 13. G. Stradiotti. Male, 48 years old, with genu valgum. Twenty years ago, after a long walk, he noticed a painless swelling of the right knee which disappeared in a week. Four years later, after another long walk, the swelling returned in the same knee, without pain or fever. After this he had several attacks lasting from five to fifteen days at a time. They became milder and finally disappeared.

CASE 14. Howard Marsh (9). Woman, age 28 years. For past eighteen months right knee has had periodic attacks of swelling every fourteen days, which last three days. Examination of the fluid in the joint showed it to be serum and synovial fluid. Various therapeutic measures failed until a course of arsenic was tried for six months, when the attack ceased.

CASE 15. Howard Marsh (9). Patient 42 years old. For past two years has had periodic attacks of swelling of both knees every twelve days and lasting three or four days. Sometimes the attacks are not punctual and there has been a variance of the period from twelve to eighteen days. When the patient was put on arsenic the intervals became longer and the attacks shorter, and at the time of report had had none for six weeks.

CASE 16. Howard Marsh. Boy, 16 years of age. Effusion into right knee after wrench at football, and periodic recurrence every twelve days for six months. Attacks last three or four days. On arsenic they grew shorter and less frequent and disappeared in four months.

CASE 17. Wm. Healy (10). Male, 42 years of age. Family history of rheumatism. Patient had gonorrhœa with two swollen knees. Three years later he had swelling of the left knee which recurred every eleven days. Under quinine medication the attacks ceased for six years. The swelling then recurred while running, and for four or five months he had fourteen day periodic attacks. He took quinine and the attacks ceased for about five years, and then in spite of quinine medication he had attacks every fourteen days. During an attack, either knee was affected without regular order, and rarely both knees, but other joints were never affected. Arsenic helped him but was not curative.

CASE 18. Wm. Healy (10). Woman, 36 years of age. Nervous. Had rheumatism at 13. For past six years has had periodic attacks of swelling in the right knee, and sometimes in the left knee, without regular alternation or known cause. The attacks would last three or four days without pain

in the knee or general symptoms. Arsenic and quinine relieved the attacks.

CASE 19. Wm. Healy (10). Woman, 34 years old, with no history of rheumatism. Has had periodic attacks of swelling of the knees every twelve or fourteen days without previous injury or known cause. The attacks last two days; the joints are red and swollen. There is no effusion in the joints between attacks. Arsenic gave complete relief.

CASE 20. A. E. Garrod (11). Woman, age 46. Always subject to urticaria. At 21 developed painful swellings of both knees and some years later the hips, temperomandibular joints, spine, and many other joints were involved without periodicity. Ten or twelve years ago, when crippling arthritis had been present for fifteen years, she had periodic hydrops in the hips every four days from onset to onset. Later the knees were involved every eight days, occasionally four days, and were followed in two days by the hips and wrists. Accompanying the knee and wrist attacks she has circumscribed edema on the lips and eyelids. Arsenic has relieved all of the symptoms of the periodic attacks except a certain amount of stiffness on the days of attack.

CASE 21. A. E. Garrod and C. J. Harrison (11). Man, 42 years old. Irregular swelling of knee with pain from December, 1902, to March, 1903. Then periodically every six or seven days, and in July every eight or nine days, he had some swelling of the knee. The fluid from the joint was sterile. In April, 1904, arsenic was given and relief followed. In July, 1905, there was fluid in the joint and the synovium was thickened and a crackle was felt on moving the joint. He was all right when he used arsenic, but later the knee gave him more or less discomfort with no periodic attacks.

CASE 22. A. E. Garrod (11). Middle-aged man. Crippling arthritis of many joints. Various joints liable to periodic swellings, the record going back for five years. The left knee generally is affected first and then the right knee shortly after or at the same time. The interval between attacks is from nine to twelve days.

CASE 23. A. E. Garrod (11). Married woman, 23 years of age. One knee affected. Primary variety. Fourteen day intervals between attacks. No change by treatment.

CASE 24. A. E. Garrod (11). Single girl, 20 years old, who is under treatment at the present time. Multiple rheumatoid arthritis from the age of 15 years. Left knee, and to much extent the right knee, affected by periodic hydrops. Seven day type of interval between attacks. Before an attack has an aura "of water rushing to the joint."

CASES 25 and 26. A. E. Garrod (11). Both men of thirty years, with gonorrhœal knees. Periodic hydrops for many years and general crippling arthritis after the periodic hydrops ceased.

For the privilege of reporting the following two cases I am indebted to Dr. Dean D. Lewis, in whose surgical clinic at Rush Medical College they were studied.

O. N., single girl, 20 years of age. Menses regular but somewhat painful. Started at 11 years of age. General health good. Previous history negative for malaria, goiter, urticaria, asthma, poluyria, vomiting, angioneurotic edema, gonorrhœa, or previous joint disease. In August, 1908, her right knee became stiff and swollen without trauma or known cause, except that she thought that tight garters might have had some bearing on the cause. The swelling lasted for a day and disappeared. The same swelling and stiffness recurred at thirty day intervals for two months, coming at the same time as her menses. At the end of the third attack, the stiffness and swelling recurred every three weeks, and with more effusion into the joint and pain. In February, 1909, both knees became affected, the left knee swelling three days after the right, and the swelling recurred at seven day periods from onset to onset, thus leaving but one day in a week that she was free from trouble. Ever since that time the periodic attacks in both knees have been regular, and only three or four times have the attacks gone over a day beyond the regular time. If an attack coincides with a menstrual period it is much worse. After the left knee becomes normal there is a feeling as if something had "caught" in the left hip, and about once a month a circumscribed area over the wrist and right elbow becomes stiff. At any time when the wrist is used at all hard it becomes a little sore and swollen. The jaws occasionally become stiff during the knee attacks. The onset of an attack in the knees is generally sudden and often comes in the night. Stiffness in the right knee is the first symptom and is followed in a few hours by marked swelling, which is not periarticular and is symmetrical. The patella floats and the prepatellar bursa is not involved. The joint becomes partially flexed, is painful on motion, and flexion and extension are much limited. The skin over the joint is somewhat hot, but the skin is not red. The patient has a slight temperature of about 100 degrees and a leucocyte count of about 11,500. The swelling and stiffness go away rather suddenly on the night of the second day or on the third day, at which time the left knee has its onset of symptoms and runs through the same cycle of events. The right knee often remains slightly swollen for weeks at a time. While the patient has been very much handicapped during these attacks, she has remained at her work, that of a stenographer, almost all of the time. The knees were aspirated and injected with iodoform and glycerine emulsion during an attack. The fluid obtained was straw colored, viscid, and of syrup like consistency. Stained smears showed no organisms and cultures were negative. A number of polymorphonuclear leucocytes were seen in stained specimens. The fluid coagulated on standing in a few minutes. A general physical examination gave no evidence of visceral disease.

C. G., traveling salesman, 31 years old. His father had an attack of synovitis of the knee at one time. No history of malaria, urticaria, goiter, asthma, angioneurotic edema, or gonorrhœa. Patient in good general health, twenty-two years ago patient had a swelling of a finger on the right hand which recurred twice after a period of relief. The right ankle then became swollen for about three days at a time with an eleven day interval for a period of six months. The right knee then became swollen, stiff, and painful for three day attacks, at an interval of eleven days; the joint was normal in the interval between attacks. The patient has been able to continue at his occupation during most of the attacks. There are periods, for six months at a time, when he has no trouble at all. In the spring of the year the attacks are more severe and the patient is often obliged to take to his bed. In a few instances the left knee has been swollen during an attack of the right knee. At the onset of some attacks the patient has a polyuria. During an attack the right knee suddenly becomes swollen and very painful, and the right ankle somewhat swollen and stiff. The knee is held in a semiflexed position and motion is painful and restricted. The skin is hot and somewhat red over the joint. He has a slight fever of about 100 degrees and the leucocytes are about 11,000 per cm. In the past few years he has had his joint aspirated eight times and injected with iodoform or formalin glycerine emulsion, and has gained relief for a period of a few months. He has taken thyroid extract without any benefit. The fluid from the joint was clear and somewhat viscid, and cultures from it were negative. General physical examination gave no evidence of abnormalities. At the present time he is relatively free from attacks of hydrops, but says he expects to have them in the spring.

ETIOLOGY

In the catalogue of etiological factors there are no specific causes, but the influence of infectious diseases, trauma, and neurotic conditions seems to play the most important rôle.

Hereditary transmission of the condition probably never occurs. Blanc reports an instance where the patient's mother also suffered from recurrent hydrops of a joint. A history of family neuroses is not infrequently obtained. A family rheumatic diathesis was present in two cases of this series. (Healy, Schlesinger.)

Infectious diseases have been looked upon by some as a causative agent. Acute rheumatism has preceded only two of the cases in this series (Healy, Schlesinger) and was three and fifteen years before the onset of the recurrent hydrops, respectively. One patient in Benda's series had acute rheumatism shortly before the onset of the hydrops.

Chronic rheumatism, in which the recurrent hydrops is an episode, has been present in but three cases of this series and in a few of Benda's, under the terminology of chronic arthritis, arthritis deformans, and neuropathic joints. These are the cases known as the symptomatic type of recurrent hydrarthrosis.

The frequency in which gonorrhœa attacks the knee joints compels one to look with more than ordinary care for its presence as an etiological factor. A history of gonorrhœa was obtained in but three cases, and in all of these gonorrhœal arthritis has been a complication. (Healy, Garrod.) Two of these cases had the recurrent hydrops as an episode in the course of gonorrhœal arthritis of the knees. In Benda's series, Billroth's cases had gonorrhœa and in von Weiss' case the hydrops developed on a gonorrhœal joint. Careful bacteriological search for the gonococcus in the joint fluid of our cases was futile.

Although a malarial history has been obtained in a few cases, and quinine has been of therapeutic benefit in some instances, the plasmodium has never been found in the blood during an attack of periodic hydrops. In addition to recurrent attacks of malaria, Stradiotti's case had attacks of hydrops of the knee, which started after an attack of malaria, and recurred every year.

Syphilis probably plays no rôle in the etiology. Late hereditary lues was present in Friedenberg's case and a history of syphilis sixteen years before the report of his case was obtained by Chauvet.

Osteomyelitis was associated with periodic hydrops in one case (Ehrlich) and when the osteomylitic focus was removed the hydrops ceased.

Sex. The sex of the patients in 85 cases was practically evenly divided, there being 42 women and 43 men.

Age. The age of the patients varied from 10 to 60 years, but 73 per cent were between 15 and 40 years of age. As these ages were

taken at the time of publication of the cases, probably the onset took place somewhat earlier. In our series the onset of the first attack was before the age of forty in all of the cases.

5 to 10 years of age	1
10 to 15 years of age	7
15 to 20 years of age	11
20 to 30 years of age	25
30 to 40 years of age	23
40 to 50 years of age	12
50 to 60 years of age	1
Not known	3
Total, including Benda's cases	83

General health. The general health of the primary cases was good in practically all instances except where functional or organic nervous disease was present. In 22 primary cases of this series, the general health of the patients was uniformly good. In the symptomatic group the concomitant arthritis made many of them invalids but generally speaking there were few evidences of organic visceral lesions.

Occupation. The occupation of the patients has varied widely, but it has been suggested that hard work and exposure predisposes to the establishment of the condition.

Menses. The menses being a periodic function, have naturally been considered from a causative standpoint, but their influence as an etiological factor probably need not be seriously weighed. The onset of attacks, in Senator's case, came shortly before the menstrual periods, and in two other cases the first attacks coincided with the menses. (Burchard, own observation.) There are numerous instances where the attacks were aggravated when they happened to coincide with the menstrual period and periodic hydrops of the 14 day interval type may coincide with the menses every other time. The attacks have been spoken of as a type of vicarious menstruation, but Benda says that there are no cases on record in which the hydrops took the place of the menses or recurred regularly with them for any length of time.

Pregnancy. Pregnancy and the puerperium are not factors as a cause, but often alter the course of the periodic hydrops.

Trauma has played an undoubted part in the appearance of the condition in several cases. A wrench of the knee started the trouble in Marsh's case, and a blow on the knee preceded the attacks in one of Lineberger's cases. Schlesinger reports trauma to a joint a year previous to the onset of the attacks, and a slight trauma preceded the attacks in Brackett and Cotton's cases. Slipping on a stone, long walks or marches, traumatic synovitis, kneeling to wash steps, and luxations of a joint are some of the traumatic agents detailed as predisposing or causative factors in Benda's series of cases.

SYMPTOMS

The symptoms of intermittent hydrarthrosis are typical, but in almost every case there are individual peculiarities in addition to the cardinal symptoms.

Prodromes or aura before an attack are usually absent. Rarely malaise, languor, pain and weakness in the joints, headache, slight fever, or palpitation of the heart are present. One of Garrod's cases had a distinct aura of "water rushing to the joint" before an attack.

The onset of the hydrops is usually sudden and often comes in the night. In most cases the onset can be anticipated at a definite time of the day in every attack. Lineberger showed by measurement of the joint that the onset of hydrops was gradual in some cases and that the interval between attacks was shorter than the patients had supposed.

Swelling of the affected joint is generally the first symptom. It increases for 24 to 48 hours to its acme, remains stationary for a few hours, and then gradually decreases until the joint is normal at the end of the third or fourth day. Measurements taken four or five times a day showed fluctuations in size of the joint affected. (Lineberger.) The swelling is usually symmetrical and limited to the synovial cavity. The skin over the joint has been edematous in several cases. (Senator, Goix, Perrin, Benda and Schlesinger, Healy.) Slight swelling of the joint between attacks is an occasional finding. (Schlesinger, Weiss, own observation.) The hydrops has been observed to be greater

when the attack coincided with a menstrual period. (Vogt, Fiedler.) In place of the hydrops, pain alone has been noted at the regular time for an attack. (LeDentu, Benda, Schlesinger.)

Pain in the joint attacked is a variable symptom, but stiffness is practically always present. The pain may be so severe as to render opiates necessary or to oblige the patient to absent himself from his work. In most of the cases, however, the vocation of the patient is not interrupted by an attack, and pain may be entirely absent. (Marsh.) The pain is commonly worse if the menstrual period comes at the time of an attack. The patient may have radiating pains from the joint, or muscle cramps. (Chauvet.) In this series of cases, thirteen had some pain and two were occasionally disabled by it.

Redness of the skin over the joint affected and an increased local temperature has been noted by Schlesinger, Healy, and Burchard, in this series.

The appearance of the joint during an attack in most cases is that of symmetrical swelling without redness or edema of the overlying skin. If the knee is affected the patella floats. The bursæ about the joint are rarely involved. There is generally some limitation of motion, which is especially pronounced in cases in which pain is a prominent symptom. X-ray examination of the joints has not been fruitful of significant findings. In practically all cases the appearance of the joint is normal between attacks, but crepitus on motion and slight swelling have been observed.

The character of the joint effusion has been without exception that of synovial fluid with an admixture of serum. Attempts to cultivate an organism from the fluid have been unproductive. (Lineberger, Garrod, Marsh, Schlesinger, own observation.) Hartmann found a typhoid like organism in one case but did not prove its identity by cultures. The color of the fluid is clear golden yellow or colorless and does not contain pathological elements.

The joints affected vary at different times during the course of the condition, but the knees are affected in 98 per cent of all cases, and are the only joints involved in nearly three-fourths of the cases. A table is presented, made from Benda's and our series, showing the joints involved.

Right knee alone	14	
Left knee alone	11	
Doubtful which knee	10	
Both or alternating	27	73%
Right knee and other joints	1	
Left knee and other joints	3	
Both knees and other joints	17	25%
Elbow alone	1	
Ankle alone	1	
	85	

While one knee may be the only joint affected at the onset, pregnancy, treatment or unknown causes may induce involvement of the other knee, which may have periodic hydrops in a cycle alternating with the first joint or coinciding with it. (Garrod, own observation.) In addition, other joints may be affected in the same manner. In one of our cases the first swelling occurred in a finger joint for three attacks, and then in turn involved the right ankle and finally the right knee in periodic attacks. At the present time the attacks in his right knee are the worst, but there is also swelling in the left knee and ankle at times. Practically every joint in the body has been named in case reports, as participating in the hydrops or stiffness of an attack. The small joints of the hands, the temperomandibular, the vertebral, and the elbow joints have been named especially in cases where other joints in addition to the knees have been involved. These joints are not involved in every attack and stiffness alone occurs in them fully as often as swelling.

The interval between attacks is generally estimated from the onset of one attack to the onset of the next attack. In reviewing the recorded cases one notes a wide variance in the interval ranging from two days to a year, but in the great majority of cases, the time between attacks is under 14 days. In 16 out of 22 records in the present series of cases the interval was 10 to 14 days. Of these 8 cases had an interval of 10 days, and 5 an interval of 14 days. Benda thinks that in

order of frequency the 11 or 13 day type is most common, then the 7 to 9 day type, and third in frequency is the 14 day type. In the familiar type the interval is exact over long periods of time, but may change its rhythm by the influence of pregnancy, treatment, or unknown causes. (Schlesinger, Burchard.) Unexplainable absence of attacks for a few months to years has been observed. Though many patients may feel sure that the interval is exact, observations of the time of the attack kept over a long period show fairly frequent variations of a day or so. (Garrod.) By numerous measurements of the joint before and after the attack, Lineberger has demonstrated that the free interval between attacks is often much shorter than supposed, and several cases have had visible swelling between attacks.

The duration of an attack in a joint is commonly from 3 to 4 days. When there are two or more joints affected in a cycle the total time consumed may be much more. One of our patients had an interval of seven days from onset to onset of attacks in the right knee, but the left knee was attacked two or three days after the right, so that in every week she had but one day of freedom from trouble. The duration of an attack may vary from one to fifteen days. In twenty cases of this series the duration of the attack was as follows:

2 days	2
3 days	7
3 to 4 days	1
4 days	6
4 to 5 days	2
5 days	1
5 to 15 days	1
	20

General symptoms during an attack are not uncommon, but are by no means a striking feature of the condition. Excepting nervous diseases and chronic arthritis, the general good health of the patients with intermittent hydrarthrosis is proverbial. Many cases have no general symptoms at all and are not compelled to abandon their vocation even during attacks. If there are prodromal symptoms they may continue during an attack. Temperature of 99 to 100.5 degrees is commonly noted during an attack. The leucocytes are from 11,000 to 12,000 per cm. Headache, sweats, nausea, diarrhœa, polyuria, weakness, and trembling have been noted. In nervous cases the symptoms are often exaggerated.

The course of the intermittent hydrops is chronic, lasting in this series of cases from six months to 30 years. Not infrequently there are intermissions. During pregnancy and the puerperium the attacks are generally absent. (Moore, Fridenberg, Schlesinger, Burchard.) Treatment may suspend the attacks for a time, as has been shown following aspiration and injection of the joint (own observation) or arsenic and quinine therapy. (Healy.) Nervous and psychic influences seem to play an important rôle in the course of the disease in some instances. One patient had an onset of an attack whenever he quarreled with other patients and another when she was being prepared for an operation. On the contrary, fear of an operation has postponed an attack. Various functional and organic nervous diseases, as Graves' disease, neurasthenia, hysteria, migraine, epilepsy, and progressive paralysis, have been associated with a recurrent hydrops. In the present series there were no cases of organic nervous disease and only two of functional disease. (Healy, Burchard.) In Burchard's case, when the patient had asthma she had no hydrops in the knee, and vice versa, so that she spoke of the hydrops as asthma in the knee. She also had angioneurotic edema of the foot, which type of swelling of the skin was noted by Senator and Garrod in their cases. Nervous tachycardia at the time of attacks was observed by Moore and Lowenthal. Polyuria, diarrhœa, and urticaria, also were present in a few instances, and in one case (Pletzer) the hydrops alternated with acute attacks of Basedow's disease. The influence of seasonal changes has had but scant mention. One of our cases says his attacks are always worse in the spring of the year. Generally speaking a few cases having periodic hydrops of the joints have a regular rhythm which does not change for years, but a large number have a predominating type of interval between attacks

which changes its rhythm by treatment, during pregnancy, or from nervous influences.

THERAPY

The therapeutical measures at our disposal are largely empirical and include a lengthy list of pharmaceutical and surgical agents that proves the inefficiency of any one of them. There are no specifics. Of drugs, arsenic, in the form of Fowler's solution, and quinine, have given best results. In the present series of cases arsenic apparently cured four cases and helped five others. Arsenic and quinine together improved two. One was cured by guiaquin (Brackett and Cotton), and one ceased spontaneously. Of the twenty-eight cases, five received no relief from any form of treatment. Other drugs used with practically no result were salicylates, potassium iodide, thyroid extract, iron, ergot, and hypodermics of adrenalin chloride. Rest and immobilization of the joint is unsatisfactory, as the attacks recur at their regular periods. Bier's active and passive hyperemia have been used with some success. Of more radical surgical methods, the application of the actual cautery to the joint, aspiration of the joint fluid, and washing out the cavity with phenol, bichloride of mercury, and iodine, have been used with varying success. Aspiration of the joint and injection of iodoform and glycerine emulsion relieved two patients for a time. Ehrlich cured his cases by removing a focus of osteomyelitis near the affected joint. While no single method of treatment obtains the desired relief, the use of arsenic seems to be the method of choice in most cases.

SUMMARY

The nature of intermittent hydrarthrosis is based on theoretical grounds and therefore in its consideration there is a lack of unanimity of opinion. Von Grube, Hartmann, and LeMemme speak in favor of an infectious basis, but against this view must be urged the slight constitutional disturbance, during attacks, the relative good health of the patient for such a chronic process, and the absence of micro-organisms in the joint fluid. It is also highly improbable that a specific micro-organism could in one instance cause weekly attacks, and in another fortnightly attacks, over a long period of time.

As a peculiar manifestation of malaria, the history of an infection with the plasmodium and the therapeutic benefit of quinine in several instances, are of doubtful value in choosing it as an etiological factor. No case is recorded, moreover, in which the plasmodium was found in the blood during an attack. In our twenty-eight cases only one gave a history of malaria, and in this case (Stradiotti) the propriety of including it in the cases of intermittent hydrarthroses is not assured.

To consider it a peculiar manifestation of auto-intoxication or uric acid diathesis is to disregard the findings, in a great majority of the cases, where visceral lesions, consequent to a long standing intoxication, are absent.

The condition is probably not akin to acute rheumatism, gonorrhœa, or syphilis. Lineberger cites 25 cases who had acute or chronic arthritis in conjunction with periodic hydrops, but among these were some cases of traumatic arthritis. He draws attention to the fact that some cases of chronic hydrops may become intermittent and, on the contrary, that hydrops of the periodic type may not always disappear between attacks. While it is undoubtedly true that a fair number of cases seem to have a more or less intimate relation to the arthritides and are episodes in their course, it should just as emphatically be stated that many cases are in no way related to and do not occur with any type of arthritis. That the periodic hydrops are not types of arthritis is shown by the absence of joint changes and lack of pathological elements in the joint fluid.

Many authors believe that the condition is a type of secretory angioneurotic edema, and much of the clinical evidence favors that view. The history of family neuroses in some cases, the association of functional and organic nervous diseases in others, and the peculiar likeness of the non-inflammatory hydrops to Quincke's angioneurotic edema of the skin, and finally, the presence of symptoms such as urticaria, polyuria, diarrhœa, asthma, and migraine, in certain cases, favor strongly the influence of nervous factors. The cessation

of attacks during pregnancy, their aggravation when they coincide with menstrual periods, show their relation to these highly complex nervous phenomena. Schlesinger terms the picture hydrops hypostrophos, or recurring swelling, because he believes it is a type of angioneurotic edema. He says that each often follows psychic conditions or slight trauma, that certain regions are more affected, that they both have periodic onsets which are not always regular, that both are temporary, and that in the interval the region seems normal. Burchard's case would certainly seem to come in this class. It is a fact, however, that many cases occur without family neuroses or presence of nervous symptoms. Benda says that the symptomatic cases occurring with chronic rheumatism or arthritis deformans may be due to the same spinal cord lesions which have been demonstrated in the chronic arthritides. Hildebrand describes the dense network of blood-vessels supplying the capsule of the knee and the rich nerve supply of even the smallest vessels. He thinks that sense bulbs on the serosa of the joint may be stimulated, by agents not felt by the patient, to produce a transudate, or that by other general nervous stimuli the vessels could reflexly pour out a transudate. These considerations are highly theoretical, but the clinical fact remains that the history and clinical data of a considerable number of cases are similar to those of functional neuroses and especially to angioneurotic edema.

There are typical cases of intermittent hydrarthrosis in which an absence of rheumatic history, malaria, or other infectious diseases, family neuroses or functional nervous symptoms, or any known relation to neuroses exists. We are therefore forced to the conclusion that an adequate explanation of the origin of every case does not exist. That some of the cases are related to the neuroses, that others seem akin to acute or chronic arthritis, and that still others may be peculiar manifestations of an infectious process, is a matter of clinical record. To dignify the symptom complex of intermittent hydrarthrosis as a disease, sui generis, is not warranted by the facts at our disposal. It seems especially desirable for every case to be made a matter of record, so that with increasing carefully tabulated clinical pictures of the condition its most salient points may be impressed upon us and its pathogenesis possibly be acceptably explained.

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DEPARTMENT OF TECHNIQUE

THE RADIOGRAPH SHADOW AND THE CYSTOSCOPE

By W. F. BRAASCH, M. D., Rochester, Minnesota
Physician to St. Mary's Hospital

ANY one who has had considerable experience with findings in the radiograph will hardly rely upon the presence of shadows for the sole basis of a diagnosis of lithiasis.

The numerous conditions other than stone which may cast shadows within the limits of the urinary tract are well known. Naturally the better the radiographic technique and the more experienced the operator, the more accurate will be the interpretation of the plates. But even with the best radiographic technique and extensive experience, very frequently findings in the radiograph will not tally with the clinical evidence, or will require further data before their identity can be established.

The data which we usually depend upon to aid us in our interpretation are those obtained from the subjective symptoms, the physical examination, and the cystoscope. Experience has taught us that subjective symptoms referred to in the urinary tract are often unreliable. Objective data must be very evident to be of practical value and are not often found with lithiasis. Urinalysis, without gross evidence of pus or blood, is of but little practical value. Evidence obtained through the cystoscope and the ureteral catheter will usually be found our most valuable aid.

1. *Meatoscopy.* A pouting, markedly inflamed meatus may suffice to identify stone just within the orifice. Occasionally the stone will be seen partially protruding. Cloudy urine from the affected side, when tuberculosis has been excluded, may also be sufficient evidence.

2. *Obstruction to the ureteral catheter.* The ureteral catheter encounters obstruction in about three-fourths of all ureteral stones. About two-thirds of these can be passed by the ureteral catheter. The sudden rapid flow of urine after the catheter has passed the obstruction is usually positive evidence of actual intraureteral obstruction. If the catheter encounters such a rapid flow after passing an obstruction at the level of a shadow to be identified, the probability of stone is rather certain. The urine collected in these cases is usually a dark, reddish yellow, more or less turbid, and microscopic examination will show a varying number of pus and blood cells. The flow of urine will continue for a variable length of time, depending upon the degree of dilatation above the obstruction. The urine above the obstruction caused by tuberculous ulceration, or which occurs with anatomical hydronephrosis, is usually pale and cloudy to a varying degree.

3. *The styletted catheter.* When the wire stylet was first suggested by Kolischer and Schmidt, we hoped that indefinite ureteral shadows could be identified by its aid. Its practical value has not, however, come up to our expectations. We have frequently found a shadow in the radiograph which appeared to be due to a stone in the ureter. The styletted catheter (or still better a catheter impregnated with collargol previously injected) was introduced and in a radiograph then taken the evident stone-shadow would appear to be touching that of the stylet. By taking the radiograph at various angles and even stereoscopically, another dimension, namely, that of depth, was gained. It would often appear from such a carefully taken radiograph that the shadow-casting substance must be within the ureter. At operation, however, the surgeon very often finds phleboliths and calcified areas in the blood-vessels of adjacent tissue or even in the ureteral wall itself, as the cause of the shadow. The distance separating the stylet and the extraureteral body is sometimes so little as to be of no practical value in the radiograph. Furthermore, we may find a variable space separating the stylet and a ureteral stone, depending upon the degree of sacculation of the ureteral wall above the stone. However, it is quite exceptional to find a ureteral stone more than a centimeter distant from the stylet. Therefore it would seem that a shadow appearing adjacent to the stylet, even though taken at various angles or stereoscopic, is not

Fig. 1. Stylet evidently touching intraureteral shadow; at operation found to be a phlebolith.

Fig. 2. Ureteral distension above a stone at sacroiliac region which was invisible in the original radiograph.

necessarily within the ureter; while if at some distance from the stylet (a centimeter or more) it is probably without the ureter. In other words, only the negative findings are of practical value.

4. The injected radiograph. Dilatation of the ureter above the obstruction will occur to a varying degree depending upon the extent and duration of the obstruction. To the operator, this distension, which is readily felt, gives sufficient proof of an obstruction below. The distension can be readily outlined in the injected radiograph. It will then appear to vary from a nodular swelling at the point of obstruction to an extreme distension of several centimeters, above it. Of twenty-two cases of stone in the ureter seen in St. Mary's Hospital during the past year, evidences of dilatation above could be demonstrated quite clearly in eleven cases. In three other cases the evidence of dilatation above the stone was too indefinite to be of practical value. In eight cases, or about a third of the total number, the catheter met with an impassable obstruction and the fluid returned at once. In six of these eight cases the stone was either within or just beyond the bladder segment of the ureter, a situation which is apt to prevent both catheter and fluid from passing. With small stones situated in the upper ureter an injected radiograph may occasionally demonstrate a dilatation above a suspected shadow even if no definite obstruction can be made out with the catheter. Stones in the upper ureter, at or near the ureteropelvic juncture, will usually cause more or less distension of the pelvis, which may be readily demonstrated in the injected radiograph. The distension is not, as a rule, so large as that accompanying mechanical dilatation of anatomical etiology. Stones within the pelvis frequently cause distension of partially obstructed calyces or are the cause of marked irregularity within the pelvic outline following inflammation.

IDENTIFICATION OF SHADOWS IN KIDNEY REGION

Shadows which are more apt to confuse interpretations in the kidney region are those due to

Fig. 3. Nodular widening due to small stone. Moderate distension above; none below.

Fig. 4. Unidentified shadow in ureteral area.

Fig. 5. Distension of ureter and pelvis above shadow; at operation found to be stone.

(1) single cortical stones, (2) tuberculous lesions, (3) gall-stones, and (4) superficial bodies.

1. Cortical stones. It is well known that single cortical stones may exist in the kidney for years without causing symptoms. Their accidental finding in the radiograph may confuse the diagnosis of lesions existing in other organs. If the secretion in the affected kidney is shown to be undisturbed, and the injected radiograph shows no evidence of inflammatory changes, it is probable that other conditions cause the patient's symptoms. The exact position of the stones can often be ascertained in the injected radiograph.

2. Shadows accompanying tuberculosis. A considerable number of patients suffering with tuberculosis in the genitourinary tract will show shadows in the radiograph simulating lithiasis. The shadows are probably caused by lime-salts in caseous tuberculosis degeneration which may exist either in adjacent glands or in the kidney substance. The shadows within the kidney are usually of two types: (1) numerous small, granular shadows grouped together; (2) larger, hazy shadows varying in size from a filbert to a cast of the entire caseated kidney. Judging from their appearance in the radiograph alone, they might easily be confused with simple lithiasis. The cystoscopic data are sufficient to recognize their nature in most cases.

Fig. 6. Gall-stone shadow at side of normal pelvis.

3. Gall-stones. During the past year we have found gall-stone shadows in the radiograph in six cases. Doubtless they can be radiographed oftener than we have formerly supposed possible. When found, they are often seen in the kidney area, and they must be considered in the interpretation of every plate.

The typical gall-stone shadow has a dark cortex and a light rim, and it is dimmer than that of renal stone. Usually one is seen, although there may be several. The catheterized specimen from the kidney gives a negative urine.

The injected radiograph will be found of considerable aid in differentiation, (1) if the injected pelvis is seen at some distance from the suspected shadow (say over three inches) the possibility of cortical stones is usually excluded. (2) Very often the gall-stone shadow will be seen partially overlying the pelvis or situated in extraordinary

Fig. 7. Distension of right ureter and pelvis resulting from stricture at bladder segment. Stylet visible in left ureter passing at some distance below shadow.

Fig. 8. Distended pelvis above obstruction to ureteral catheter at a distance of 10 cm. above the bladder.

relations to it. (3) The stereoscopic radiograph in some cases reveals the difference in the level. It is preferable to use weaker solution of the injected material to dimly outline the pelvis so as not to obscure partially overlying or adjacent gall-stone shadows. The use of air as the injected material would seem particularly advantageous in such cases but it has not proved satisfactory in our plates.

4. *Shadows caused by superficial bodies.* These shadows are often met with in the radiograph. As a rule, their character and situation with relation to the kidney shadow suffice to identify them. The injected radiograph and the stereoscope may be of considerable aid in their interpretation.

5. *Ureteral obstruction without shadow.* That the ureteral catheter may meet with obstruction with various conditions is well known. I described many of the possible causes in a previous paper.[1] The problem we always have to consider in interpreting ureteral obstruction is whether it is due to blocking of the ureter through a stone or stricture, or because of physiologic conditions. Wherever there is obstruction due to stone or stricture there is more or less ureteral dilatation above it. This can often be demonstrated in the injected radiograph. Where the catheter is obstructed by some physiological or anatomical peculiarity without actual narrowing of the ureteral lumen, there will be no dilatation above it. We have repeatedly found stone in the lower ureter where, because of its size, character, or position, no shadow would be visible in the radiograph. This might easily occur with faulty radiographic technique, but even with the greatest care and with the radiograph taken at various angles, small stones in the lower ureter may be missed in considerable percentage of cases.

Strictures of the ureter are readily demonstrated in the injected radiograph. They may be due to a variety of causes; more often resulting from tuberculosis, trauma from ureteral

Fig. 9. Inflammatory dilatation of the calyces due to stone in upper calyx whose shadow in the original radiograph was suggestive of gall-stone.

[1] Surgery, Gynecology and Obstetrics, October, 1909.

stone, operative injury, and congenital etiology. The degree and extent of ureteral dilatation above a stricture, as well as the extent of the pelvis distension can be definitely ascertained. With these data definitely known, the method of operation is clearly defined.

Our method of procedure in cases where the radiograph shadow demands further identification would be, in short, as follows: (1) Meatoscopy. (2) Ureteral catheterization to ascertain the character of the urine and the existence of obstruction. (3) Injection of the opaque silver salt to ascertain the relation of a shadow to the catheter and existence of ureteral dilatation. It might be argued that such a prolonged and painful procedure is scarcely warranted for diagnosis. However, there is no reason why the method should cause any more discomfort than any other thorough cystoscopic examination. The time required depends entirely upon the skill of the endoscopist and the radiographer, and their technical facilities.

CONCLUSIONS

1. A considerable proportion of shadows in the radiograph require further identification.
2. Data for identification are best obtained through the cystoscope and the ureteral catheter.
3. The catheter shadow (stylet) is only of value when the suspected shadow is a centimeter or more distant.
4. Ureteral dilatation above a stone can be demonstrated in the injected radiograph and will serve to identify a doubtful shadow.
5. Ureteral dilatation above obstruction to the ureteral catheter will demonstrate actual constriction of the ureter due to stone or stricture.
6. The identity of shadows cast by gallstones, tuberculous tissue, and extrarenal bodies, is often established with the aid of the cystoscope and the injected radiograph.

VENTROSUSPENSION BY THE ROUND LIGAMENTS FOR BACKWARD AND DOWNWARD DISPLACEMENT OF THE UTERUS

By HIRAM N. VINEBERG, M. D., New York City, New York
Adjunct Attending Gynecologist to Mt. Sinai Hospital; Attending Gynecologist to Har Moriah Hospital, etc.

THE operations devised for the correction of backward displacements of the uterus are exceedingly numerous. In most of them, the round ligaments are made to play, in some manner or another, a very important rôle. Several of these methods, no doubt, have given and are giving good anatomic and therapeutic results, others seem to be the fruit of rather a fanciful imagination, based on an anatomy that exists more definitely in the author's brain than in the human economy.

It would seem to us that that method would be the most desirable which is the simplest in its technique, that is attended with the least traumatism to the organs and structures concerned, and which gives as good results from an anatomic and therapeutic standpoint as any of the other methods that, so far, have been devised.

It has always been a matter of surprise to the writer to note the great ingenuity displayed by very capable men, in their efforts to devise a complicated method of suspending the uterus by the round ligaments, when a simple one accomplishing the same thing was at hand all the time.

I refer to the operation commonly known as "Olshausen's," which concisely described, consists in suturing the round ligaments to the abdominal wall, and which I have been employing for over fifteen years. It has given me such uniformly good results, that I feel I will be doing the profession a good service by drawing their attention to it and renewing an old acquaintance, with the aid of a few drawings.

My present method of performing the operation differs in some respects from that originally described by Olshausen, but the main features have remained practically the same.

The steps of the operation are as follows:

1. Median abdominal incision, varying in length from 2 to 4 inches, according to the thickness of the adipose tissue.
2. The skin with the underlying fat is dissected off on either side from the rectus fascia, to the width of one and a half to two inches. This is easily done by seizing the fat layer with a couple of sharp retractors near the cut edge of the fascia, and with a few strokes with the scalpel and by pressure with a gauze sponge, the rectus fascia is exposed the required width. The

uterus and adnexa are then brought up to the incision for inspection. A good sized gauze compress is placed in the abdomen behind the uterus, serving the double purpose of keeping the intestines away from the field of operation, and of retaining the uterus in a good position. Care should be taken not to cause an abrasion on the uterine wall, by any instrument, so as to preclude the probability of an adhesion of the uterus to the parietes.

3. A suitable needle (the kind, at the option of the operator) armed with a No. 2 chromic catgut suture is carried through the rectus fascia as far from the edge as the denudation had been executed. The suture passes through the fascia, rectus muscle, and peritoneum, and is carried around the round ligament from behind forward at about 4 cm. from its insertion into the uterus. The suture is then carried through the abdominal wall, minus the fat and skin, in the opposite direction from that in which it entered, that is, the needle is carried from within outward through the peritoneum, rectus muscle, and fascia and made to emerge on the line it entered on the fascia, at about an inch lower down. A second suture is passed in a similar manner about 2 cm. from the cut edge of the fascia, that is, about 2 cm. internally to the first, and is carried around the round ligament at its insertion into the uterus. A similar procedure is carried out on the opposite side (Figs. 1 and 2).

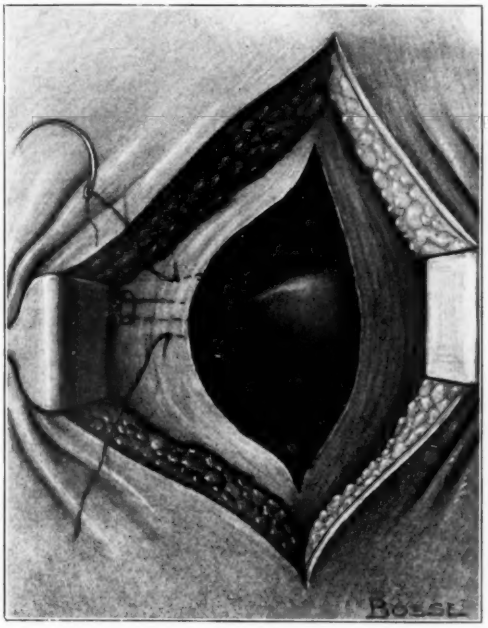

Fig. 1. The most external suture tied, the inner one seen passing around the round ligament near the horn of the uterus and through the fascia, rectus and parietal peritoneum, ready to be tied.

A few practical points relative to the passing of these sutures may be mentioned. In carrying the needle through the abdominal wall, care should be taken not to puncture the deep epigastric artery, otherwise a hematoma might result. Secondly, with ordinary care, the needle can be carried about the round ligament without puncturing any blood-vessel and thus avoid troublesome bleeding, which might necessitate a hemostatic suture.

4. The sutures are now tied upon the surface of the fascia, the outer one first, during which the inner is held taut, thus bringing the uterus well up to the abdominal wall. It is important not to tie the sutures tightly, they are merely to be knotted upon the upper surface of the fascia, so as to prevent constriction of the embraced tissues. A neglect of this precaution is often the cause of considerable pain to the patient for several weeks after the operation (Fig. 3).

5. The abdominal incision is now closed by tier sutures, with whatever material the operator prefers.

In many cases it has been my custom to catch lightly the peritoneum of the uterus, on the anterior wall, near the fundus, with the continuous catgut suture employed to close the peritoneum. This precaution was taken to prevent existence of any space between the fundus and abdominal wall, in which a loop of intestine might subsequently be caught and held, giving rise to an acute obstruction of the bowels, as occurred in a single instance, reported in the literature several years ago.

If the operation be done as outlined above, there need be little fear of this accident, in the absence of the uterine suture, as the fundus is brought up close to the abdominal wall. I have omitted the uterine suture in several of my cases and there was no difference in the results, either immediate or remote. There is just as little likelihood of this accident happening, after the above method, as after the method known as the Gilliam operation, inasmuch as the anatomic relations are similar, obtained by practically the same means. To my mind, however, it has the advantage over the Gilliam operation in being simpler and more surgical, in that no blunt instrument has to be thrust through thick tis-

Fig. 2. Frontal section showing the round ligament sutures tied in situ, viewed posteriorly. The median suture is wrong as it should pass through only the parietal and uterine peritoneum.

sues, and in that no redundant structures (the loop of the round ligament) is made to project at an abnormal site on the surface of the rectus fascia. A further advantage, in my opinion, resides in the fact that the support is not dependent solely upon the round ligament which, as we all know, is of variable size and strength, inasmuch as the second or inner suture is made to embrace the ligament at its junction with the uterus. We thus employ the ligament at its strongest point, reinforced by some of the uterine tissue.

Only a short time ago we had occasion to operate on a woman on whom the Gilliam operation had been performed a couple of years before. The uterus lay in retroversion, and that portion of the round ligament running from the abdominal parietes to the uterus had stretched to such an extent as to permit the fundus to sink into Douglas's cul-de-sac. Such an incident is always likely to happen when any portion of the ligament at some distance from its uterine attachment has to bear the strain of holding the uterus in a forward position. It is this feature of the round ligament, its tendency to stretch inordinately, when submitted to traction, that gives such a high percentage of failures to the Alexander operation and its various modifications.

During the 15 years we have employed this method, we have performed it in 240 cases. We are aware of only two or three anatomic failures. Of course many of the cases passed from under our observation shortly after leaving the hospital. But the majority of the private cases (101 in number) have been under observation ever since the operation was performed upon them, for periods varying from a few months to fifteen years.

There have been twenty-five cases of pregnancy, to my knowledge, in the cases operated upon by me. In none of them were there any disturbances during gestation, labor, or the puerperium. In a few private cases, the operated women had gone through two pregnancies and deliveries, the uterus remaining in good position afterward. I had the opportunity to examine the women sometime after delivery and in every case, with one exception, the uterus was in good position.

Until about a year ago, I had not had a fatal case connected with the operation. Then I met with the only fatal case in the entire series.

The patient possessed rather low vitality, was of a decidedly neurotic type, and suffered very materially in her general nutrition from the displaced pelvic organs and from a marked cystorectocele. After the pelvic floor was repaired, laparotomy was performed for the abdominal suturing of the round ligament. As the appendix showed moderate pathological changes, it was removed by the usual method employed by the writer. The patient developed acute dilatation of the stomach, and in spite of everything we could do, she died on the fourth day after the operation. The abdomen was opened on the third day, everything, except the dilated stomach, seemed normal. There had been no bleeding, the appendical stump was normal, and there was not the slightest sign of peritonitis. The fatal complication encountered in that case is still enveloped in a great deal of mystery. But this is not the place to enter into a discussion of it.

Fortunately, it is a rare occurrence, but it is one that has to be reckoned with in every operation, no matter how trifling. The literature contains a case following an excision of a tubercular phalangeal joint, and another case following merely an examination under ether.

In conclusion we wish to emphasize again that the method we have used for so long a time offers all the advantages of all the other methods that depend upon the round ligaments for the support of the uterus, and that it is free from most of the objections inherent to one or other of them.

Its advantages are:

1. The simplicity of its technique.

2. The employment of the ligament at its strongest point, that is, where it joins the uterine tissues.

3. It is executed with the least amount of traumatism to the tissues concerned.

4. It has stood the test of a long period of time.

5. Its high percentage of anatomic cures (being nearly 100 per cent), while its therapeutic cures are the equal of any other method.

6. Its freedom from causing any complication during gestation, parturition, and the puerperium.

This is a very important consideration, and we feel justified in making that claim after an experience extending over fifteen years, and embracing over twenty cases we have ourselves observed. Further, we cannot recall a case in the literature in which any complication had occurred in connection with childbearing, when this method was employed.

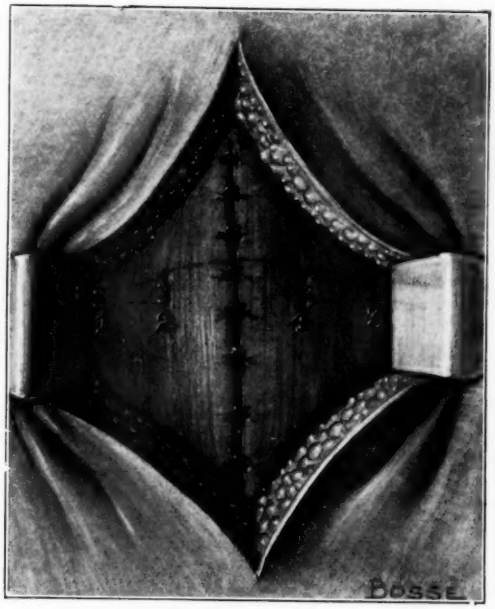

Fig. 3. The round ligament sutures tied on the fascia, and the fascia closed by interrupted sutures.

THE CLOSURE OF THE ABDOMINAL INCISION[1]

By STEPHEN E. TRACY, M. D., Philadelphia, Pennsylvania

THE closure of the incision is the termination of every abdominal operation, and, with the exception of those cases where the wound is left open, in whole or in part, for the purpose of drainage, is brought about by the use of sutures. It should be the aim of every surgeon to approximate the tissues in such a manner, that the wound will not give away a short time after the operation and allow the bowels to escape from the abdominal cavity, and by a method that will give the strongest abdominal wall with the fewest herniæ.

It is generally accepted among surgeons that the chief supporting power of the abdominal wall is the aponeuroses of the external oblique muscles. In other words, the strength of the abdominal wall is due largely to the fascia contained therein.

For many years abdominal incisions were closed by through-and-through sutures, and incisional herniæ were numerous. At a later period incisions were closed layer by layer with much better results, and now surgeons are quite generally agreed that the best union, that the strongest wounds, and that fewer herniæ follow abdominal operations when the wounds are closed layer by layer and the fascia overlapped.

For several years some surgeons buried permanent sutures in closing the fascia. During recent

[1] Read before the Philadelphia Obstetrical Society, February 2, 1911.

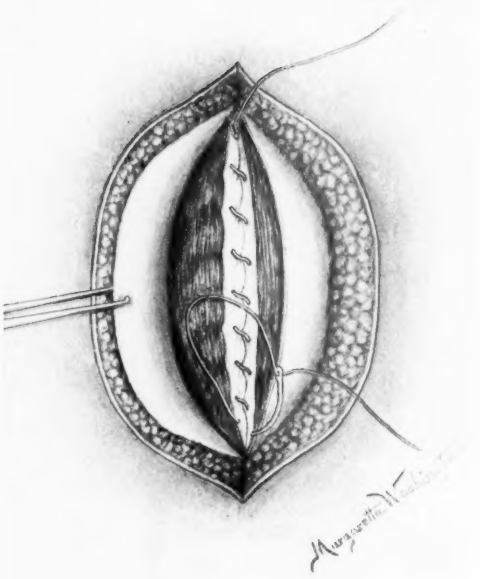

Fig. 1. Peritoneum sutured with fine catgut. Fascia separated from rectus muscle on the right side. Fat dissected from the fascia on the left side.

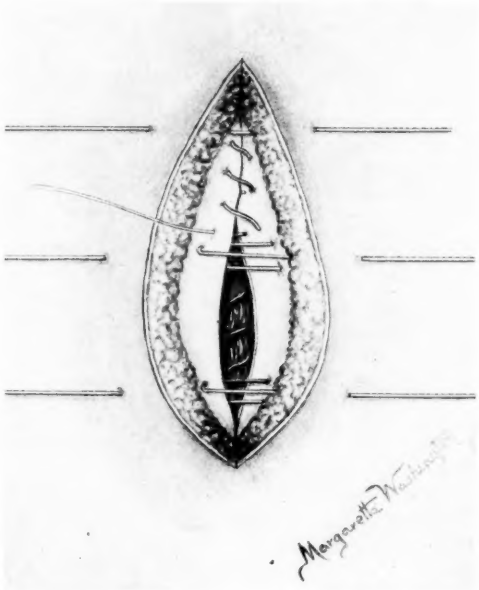

Fig. 2. Muscle sutured with catgut. Tension sutures introduced, which overlap fascia when drawn taut. Edge of overlapped fascia whipped down with chromic catgut.

years nearly all surgeons suture abdominal wounds with catgut, using chromic gut for the fascia. As a result of using catgut exclusively the majority of active surgeons have had the unpleasant experience on one or more occasions of finding that the catgut gave away, or was absorbed too quickly, and the bowels escaped through the incision, or the operation was followed by a hernia.

In order to prevent this accident removable sutures of permanent material have been used in various ways; such as sutures through all the layers of the abdominal wall, or the figure-of-eight suture through the fascia, which were tied after the wounds were closed with catgut; or mattress sutures through the fascia, brought out and tied some distance on one side of the wound. Through-and-through tension sutures will keep the bowels in the abdomen, but will allow the fascia to retract in case the catgut does not remain a sufficient time.

Tension sutures, to accomplish what is desired, should not only prevent the bowels from coming through the incision in case the catgut gives away, or is absorbed too quickly, but should overlap and keep the surfaces of the fascia together, and should be so introduced that they can be readily and easily removed.

Such a result can be secured by closing the incision in the following manner: The peritoneum is sutured with catgut, and the same suture is used to whip together the muscle. On the right side of the wound the fascia is separated back from the muscle, one to three centimeters. On the left side the fat is separated back from the fascia the same distance. Here, I wish to call attention to the importance of separating the fascia from the muscle on the right side, and the fat from the fascia on the left side. When this is not done, the fascia does not overlap nicely, and a layer of muscle and fat is interposed between the two layers of the fascia, which does not give a strong union. Tension sutures are then introduced through the skin about three centimeters from the edge of the wound, passing through the fat and the fascia about one centimeter from the edge, then in and out through the fascia on the left side from one centimeter to three centimeters from the edge and back through the fascia on the right side, then out through the fat and skin on the left side. (The loop of the mattress suture on the left side may be introduced parallel to, or at right angles to the fibers of the fascia.) The sutures are placed from four to five centimeters apart. The ends

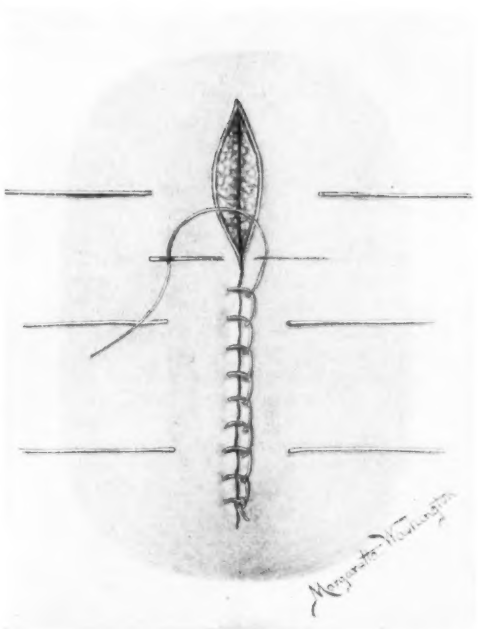

Fig. 3. Method of applying suture to close skin incision.

are then caught with forceps and allowed to rest on the abdomen until the remainder of the wound is closed. The edge of the overlapping fascia is then whipped down with chromic gut, and the skin sutured with a buttonhole stitch. If the ends of the tension sutures are drawn taut, the fascia will overlap, and the whipping down of the edge will be facilitated.

Gauze saturated with seventy per cent alcohol is placed over the wound and the tension sutures

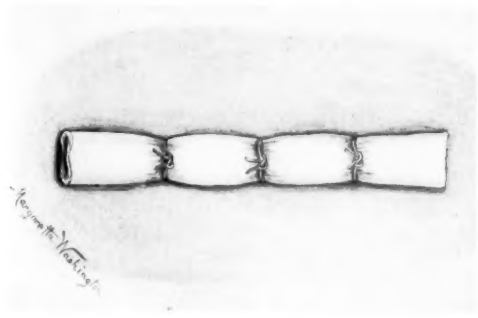

Fig. 4. Tension sutures tied over gauze.

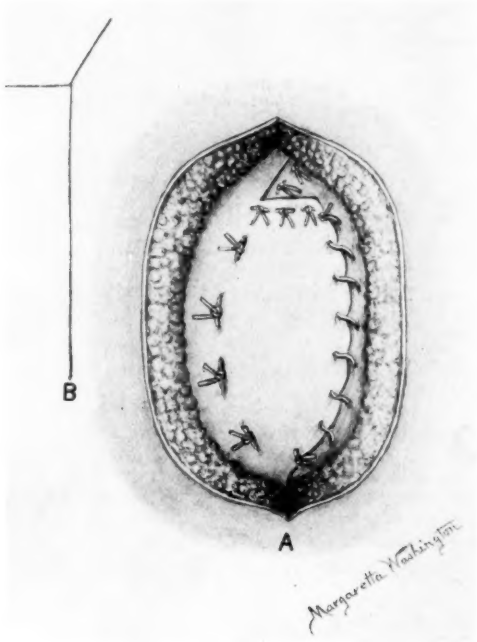

Fig. 5. A, Fascia sutured in case of marked diastasis of recti muscles. B, Angles at which incisions are made at upper end of wound.

are tied over the gauze. The tension sutures are removed from ten to fourteen days.

In patients in whom there is a wide separation of the recti muscles and marked relaxation of the abdominal wall, the fascia is overlapped to the extent the recti muscles are separated, in some cases three or four inches.

In these cases of marked relaxation, the recti muscles are dissected out and sutured from an inch above the umbilicus to the pubic bone. It is not considered advisable to constrict the upper abdomen as such a procedure has a tendency to increase the visceroptosis, which is usually present.

If the peritoneal cavity is opened when separating the tissues about the umbilicus, the peritoneum is sutured transversely as there is less tension and the approximation is better. After the recti muscles are sutured, the edge of the fascia on the left side, which is slid under the fascia on the right side, to the extent the muscles were retracted, is anchored with mattress sutures of chromic gut, and the edge of the fascia from the right side is sutured in the usual way.

In order to make a good approximation and to avoid any infolding of the fascia at the upper end of the wound, the fascia at the upper end of the incision on the right side is cut transversely, and the vertical incision carried slightly upward, and to the left. The upper segment (above the transverse cut) is then slid under and the lower segment over the fascia on the left side. The free edge of the fascia is then sutured.

When it is necessary to leave one end of the wound open for drainage, the same technique is employed except that no gauze is interposed between the skin and the tension sutures. By employing this method the separation of the fascia in the part of the wound not closed is less, and the abdominal wall is stronger than if closed by through-and-through sutures.

By this method of suturing, dead spaces are eliminated, the fascia is overlapped and approximated accurately and remains overlapped even if the catgut is absorbed in a few days. No dead space is left in the fat and the necessity of suturing this layer is eliminated. In cases where there is an excess of serum or slight oozing in the skin or fat immediately after the operation, the pressure from the tension sutures tied over the gauze will force the serum or blood through the skin incision, where it will be taken up by the gauze.

The buttonhole stitch is used in preference to the intracuticular stitch as it can be applied more quickly, the approximation is better, and superficial necrosis of the wound is unknown.

If primary union of the wound takes place, it is practically impossible for a hernia to follow when the incision has been closed in this manner, and if the technique is proper, suppuration will seldom follow.

ACUTE POSTOPERATIVE DILATATION OF THE STOMACH FOLLOWING GASTROJEJUNOSTOMY

Report of a Case

By M. R. BARKER, M. S., M. D., Chicago, Illinois

HISTORY. Widow, aged forty years. For ten years last past has suffered much with dyspepsia. During summer of 1908 suffered with nervous prostration, the culmination of overwork and worry. From this she recovered and acquired her normal nervous equilibrium, but the condition of her stomach and bowels was aggravated. During three months of the winter of 1909 suffered with an acute attack of gastric or duodenal ulcer, during much of which time, food, of any nature, was not tolerated by the stomach, and nutrition was maintained by nourishing enemata. This attack was so severe life was despaired of several times. The pain was so acute and prolonged that the administration of morphine hypodermically was frequently resorted to. Marked constipation has accompanied the condition through all of the clinical history, and later was so obstinate that cathartics followed by enemata were necessary to produce evacuations. By these measures bowel movements were, as a rule, secured daily.

After this prolonged illness the patient recovered only a degree of her former health. The gastric pain she had suffered during the attack had largely subsided.

Certain kinds of liquid foods could be taken in the stomach without distress. Milk, however, was her principal diet. If she over indulged, soreness and pain in the stomach resulted, with distension and eructations of gas and vomiting. In addition to her stomach trouble she had been afflicted with more or less pain, referred to the region of the caput coli. After her recovery from her acute attack (above described) this pain and soreness were markedly exaggerated, and there was no time, now, that she was free from them. Several examinations were made by physicians in her community, and it was thought by them that a chronic inflammation of the appendix was responsible for the whole clinical history, and an appendectomy advised as her remedy.

The immediate family history is replete with cancer. Her mother and a sister died of cancer of the stomach.

I first saw this case about the first of August, 1910, and after eliciting the above history, made a careful examination. I could not discover an innate or fundamental lack of nervous equilibrium. I think this one of the essential points to be decided in this class of cases, if surgical interference is being considered. The patient was emaciated and presented the usual features of auto-intoxication. Physical findings were negative, save as follows:

Two inches above and an inch to the right of the umbilicus was a tender point which upon deep pressure caused pain to radiate to the back, to a point

between the shoulders and to the sternum. Patient said this was like the pain she had when sick during the winter, and in the same place.

There was no tenderness in the appendical region nor any findings indicating disease. There was pain on deep palpation over right ovary. Vaginal examination revealed a cystoma of the right ovary the size of a lemon. Pressing this caused pain in the region of the caput coli and shooting down the thigh to the knee. In other respects pelvic organs were normal. From this history and the physical findings, I made a diagnosis of cystoma of the right ovary, and a provisional diagnosis of chronic duodenal ulcer, which by cicatricial formation had largely occluded the pylorus.

I, however, made it emphatic that I might be mistaken about the duodenal ulcer, some essential findings for a positive diagnosis being absent, and that her condition might be due to a diseased gall-bladder or possibly to a diseased appendix. I advised an exploratory operation, in aid of diagnosis, and then to do what seemed indicated surgically. This advice was accepted and on Sept. 5, 1910, I operated. The gall-bladder and appendix were normal. I removed the latter however, believing all appendices are a menace and should be removed during other operations, provided the added work does not impose too great a burden upon the patient's surgical endurance.

I found a chronic ulcer of the duodenum close to the pylorus, the edges of which formed a cicatricial ridge, a portion of which occluded three-fourths of the lumen of the pylorus. I at once did a posterior no loop gastrojejunostomy for relief of the condition. Operation upon the ovary was not deemed justifiable at this time.

Were it possible to have patients made to order, I could not have had one more satisfactory than this one was for the first ten days. All who have done this work know how quickly these patients respond and how rapidly recover from it and from their former troubles, when the operation is indicated. This patient was not an exception to the rule for ten days. She was not nauseated, neither was she troubled with thirst. She did not have a rise of temperature or quickened pulse. After the second day her bowels moved freely and naturally every day. After forty-eight hours all food was taken by mouth without the slightest gastric discomfort. Stitches were removed on the eighth day. Primary union. Special nurse discontinued. Patient had arranged to leave hospital on the tenth day after operation. On the morning of the tenth day after operation, I was called, stating my patient did not feel quite so well as usual. She complained of shortness of breath. I immediately responded and found her suffering considerably with dyspnœa and thirst. Pulse and temperature were normal. Bowels had not moved as was usual in the morning, neither had she passed urine. The skin was dry and parched. In response to questions she said she began to feel short of breath about two o'clock in the morning and soon after began to feel thirsty.

I removed the abdominal binder and the dressings to discover anything that might be wrong with, or about, the abdominal wound.

The condition was now revealed. Immediately on removing the binder the outlines of the stomach appeared through the thin abdominal wall. The contour of the stomach was as plain as though it were lying on the outside of the body. The stomach occupied at least two-thirds of the abdominal cavity. It presented an appearance much like a Persian figure we see so often in tapestries. The stomach and duodenum were both involved. The fundus of the stomach occupied the left hypochondriac, and the pylorus and duodenum the right lumbar regions. I immediately passed the stomach tube through which large quantities of gas escaped, which was followed by the escape of five quarts of a brownish turbid secretion. The stomach immediately began to refill, and in three hours from the first passage of the tube I passed it again, with the same results as before — the escape of large quantities of gas followed by the escape of five quarts more of the same kind of secretion. The stomach began to fill, but not quite so rapidly as before. In five hours from the second passage of the tube, I passed it the third time, with about the same results as the other two times, large quantities of gas escaping, but only four quarts of secretion was withdrawn this time. I had now removed from the stomach within a period of eight hours an enormous quantity of gas and fourteen quarts of secretion, all of which had been collected in the stomach in sixteen hours.

I did not pass the tube again until the next morning, or on the eleventh day after the operation, on which day I passed it three times, morning, noon, and evening, with the escape of large quantities of gas each time, which was followed by the escape of four quarts of secretion in the morning and by three quarts each of the other two times — making ten quarts of secretion and large quantities of gas removed during the second day of the attack.

On the third day of the attack, or the twelfth day after the operation, I passed the tube three times, the same as the day before. In the morning a decreased amount of gas escaped and two quarts of secretion. At each of the two following times no gas escaped, but about one quart of secretion each time, making four quarts of secretion and considerable gas removed on the third day of the attack. During these three days I removed a total of twenty-eight quarts of secretion and an enormous amount of gas from the stomach. On the morning of the fourth day of the attack, I passed the tube but found no gas, but about four ounces of a non-turbid green solution was removed. This was the thirteenth day after the operation. This was the last time the tube was used in the treatment of this condition. The stomach had now, to a large degree, regained its usual tone and had returned to

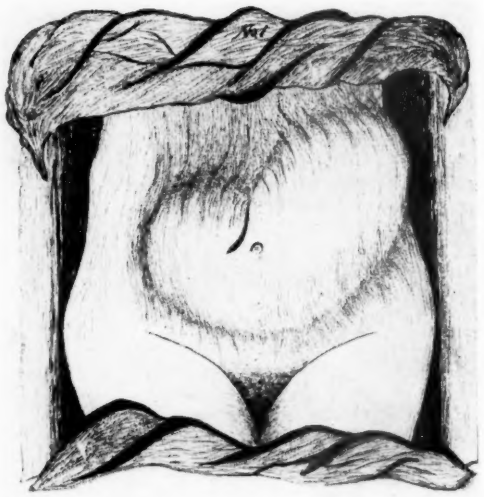

Fig. 1. Showing position of tumor.

its usual position and size. Its contour was no longer visible at any time through the abdominal wall. Each time after emptying the stomach with the tube, during this period of acute dilatation, the stomach was thoroughly washed with three quarts of hot normal salt solution, all of which was drained off after each washing, leaving the stomach empty.

On the afternoon of the fourth day of the attack, or the thirteenth day after the operation, the patient had a copious bowel movement which had the same appearance as the secretion removed from the stomach with the tube, and her urine passed and perspiration appeared for the first time since the onset of the attack. The patient had been catheterized several times but there was no urine in the bladder.

The patient had suffered with intense thirst during the whole time of the attack. The tissues of the body seemed to be anhydrous. I could not control this condition save by normal salt enemata, which were only indifferently retained. The patient was markedly prostrated, she only having received, during the attack, such nutrition as was afforded by nourishing enemata, which were never wholly retained and frequently ejected in toto.

The postural treatment was used in this case from the beginning as much as possible, the patient being placed in the prone position with the pelvis elevated and remained thus, without change for the first twenty-four hours, when a short respite was given for about two hours, when the ventral decubitus was again assumed and continued with short interruptions until relief from the dilatation was evident.

We had now conducted our patient up to the thirteenth day after operation and safely through an attack of three days and nights of acute postoperative dilatation of the stomach. There is little to say of the three following days, the thirteenth, fourteenth, and fifteenth after the operation. The patient gained constantly each day. Her bowels moved freely and naturally. She had assumed the ingestion of food into the stomach without distress or any untoward symptoms. Early in the beginning of the sixteenth day after operation, and three days after cessation of trouble from the acute dilatation, my patient was suddenly taken with hiccough. She was awakened from a quiet sleep with hiccough. She now related to me for the first time that during her illness of the winter before she was seriously troubled with hiccough. This condition lasted for thirty hours and was of the most aggravating nature, almost every breath was a hiccough. I at once passed the stomach tube and washed out the stomach with hot normal salt solution, without relief. There was nothing abnormal found in the stomach. The usual remedies and applications in this condition were unavailing, the hiccough being at last controlled by hypodermic injections of cocaine beneath the costal arch. The hiccough stopped about three o'clock on the morning of the seventeenth day after operation and about thirty hours from the time it commenced. The patient went to sleep and slept quietly most of the time up to ten o'clock in the evening of the same day, or about eighteen hours.

During this time of hiccough the patient took her food regularly by mouth and her bowels moved freely and naturally, and while the hiccough had tired her she was not so prostrated as after the stomach trouble. At this time on the evening of the seventeenth day after operation, I was again called by the nurse and told that some abdominal distension had taken place. I immediately saw the patient. On examination I found the abdomen distended fully and as tight as a drum. Temperature was 98°, pulse 100. The patient presented the appearance of one suffering with general peritonitis. All attempts at relief were unsuccessful, and the patient died at eight o'clock on the morning of the eighteenth day after operation.

The cause of the peritonitis was, in my judgment, the perforation of the old duodenal ulcer, the tissues in the base of which, becoming more attenuated by the acute dilatation, gave way under the strain of the hiccough, general peritonitis following.

The sketch from which drawing No. 1 was developed was made at the bedside a few moments before the stomach was emptied with the tube the second time, and quite accurately represents the stomach as it appeared through the abdominal wall.

Acute postoperative dilatation of the stomach, in its immediate etiology, clinical aspects, and climax, is the analogue of dynamic ileus. The remoter exciting causes, however, are wide-

ly different, one of which being a traumatic insult to the system, and the other, as a rule, an infection.

Exactly how two so dissimilar causes should produce such similar conditions in different parts of the alimentary canal, is a question as yet unsolved. It is a reasonable theory, however, that in case of ileus the end organs of the nerves supplying the intestinal walls are involved, and that paralysis of the intestines results. In acute postoperative dilatation of the stomach, however, it is a fair hypothesis that a toxin is developed in the system, due to some phase of the operative proecdure (possibly the anæsthetic), or to a combination of conditions developing from the trauma in certain rare cases. And that this toxin acts upon the cerebrospinal nervous apparatus, controlling the stomach walls, causing primary motor paralysis in every case, and that in certain other cases this toxin, because of its greater virulence, or because of less systemic resistance to its action, further acts upon the sympathetic nerve centers controlling the glands of the stomach, liver, and pancreas, overstimulating them, causing in some cases enormous quantities of secretion to be poured out, while in other cases, relatively, only a moderate amount of secretion collects in the stomach, accompanied with varying quantities of gas; while in still another class of cases the sympathetic ganglia are not overstimulated, in which cases the stomach is distended with gas alone. Hence one condition universally prevails in this malady, an enormous distension of the stomach and of the stomach and duodenum, when the latter is involved, either by secretion alone, or by secretion and gas together, or by gas alone. The collection of gas in each case is due to stagnation caused by motor paralysis of the stomach walls.

I believe the action of this toxin on the nervous structures, producing paralysis of the stomach walls, is of a fleeting nature, but always of suffixient duration to allow distension of the stomach by its contents. Subsequent to which, though the toxin, the primary cause of the stomach paralysis, may have spent itself and been eliminated, the paralysis of the stomach walls continues by reason of pressure upon or distortion of the vagi, due to the distension and displacement of the stomach, and that the favorable action of ventral decubitus in these cases is due to the relief afforded these nervous structures by this position.

This toxin may develop rapidly, precipitating an attack in a few hours after operation, or it may develop slowly, with an indefinite symptomatology and an insidious onset; or the attack may be sudden and unheralded, many days after the operation, when the patient is convalescent, as in the case herein reported.

When we ascribe to this toxin the dual potency upon different nervous structures above described, we do not give it different characteristics than is possessed by agents used daily in our work, namely, general anæsthetics.

In acute postoperative dilatation of the stomach the burden of thought has been to satisfactorily explain why the stomach becomes distended and why it does not empty itself when in this condition. The prevailing opinion among thinkers and writers upon this subject seems to be that some mechanical obstruction of the duodenum is responsible for the situation.

The case herein reported in which an opening two and a half inches long was made in the jejunum and in the most dependent portion of the posterior stomach wall, and an anastomosis made between the two organs so that a free passage between the two exists, which passage is some considerable distance beyond the termination of the duodenum, and from which stomach fourteen quarts of secretion and large quantities of gas were withdrawn within a period of eight hours, and in ten days after this opening was made, should be sufficient demonstration that the supposed mechanical obstruction of the duodenum, as an important factor in these cases, is not tenable.

It is the opinion of the author that the dilatation of the stomach by its contents, in these cases, and its failure to empty itself into the intestine, is accounted for by the following well known law of physics: Force, when confined, seeks release through avenues of least resistance.

The rapidly accumulating gas and secretion in these cases is a force. The resistance offered to this force by the paralyzed stomach walls is less than the resistance made by the intestinal tract to the entrance of material into it from the stomach. Hence the avenue of least resistance, which is the stomach walls in this case, gives way, and dilatation of the stomach results. The history of this case should be sufficient warning to those who may contemplate doing a gastrojejunostomy for relief of this condition, when it complicates other operations.

It is worthy of note that throughout all of the history of trauma, comprising both times of war and peace, that very rarely has this condition been reported following any injury, or complicating the same, save in cases where an anæs-

thetic was used and an operation performed. This fact may add a little force to the suggestion that possibly the anæsthetic may have a part in the etiology of this malady.

There are a few instances in the literature in which this condition has followed or complicated a profound, non-traumatic, toxic condition. I have only found two such cases, one of which followed typhoid fever, and the other complicated a ptomaine poisoning.

These cases, as well as those complicating non-operative traumas, tend to support that part of my contention that attributes to a toxin the chief etiological factor in these cases.

To recapitulate. I believe that acute postoperative dilatation of the stomach is primarily due to some influence which I have termed toxin, caused by some phase of the operation, or by some conbination of conditions developed therefrom, which, acting upon the nervous apparatus of the stomach, paralyzes its walls; that the action of this toxin is fleeting but of sufficient duration to allow the stomach to become distended with its contents, which distension causes a continuation of the paralysis of the stomach walls, after the action of the primary cause has subsided, by pressure upon, or distortion of the vagi by the distended and displaced stomach; that this toxin has a dual action paralyzing the motor nerves of the stomach wall but stimulating the sympathetic ganglia controlling the secreting glands of the stomach, liver, and pancreas, causing enormous quantities of secretion to be poured out, or otherwise, depending upon either the virulence of the toxin or the systemic resistance to its action; that the beneficial influence of ventral decubitus in the treatment of these cases is due to the relief afforded the vagi from pressure or distortion by this position, after the force of the primary toxin has been spent.

I believe the distension of the stomach and duodenum, and their inability to empty themselves into the intestinal tract in this condition, is best accounted for by the following law of physics: Force, when confined, seeks release through avenues of least resistance.

The paralyzed walls of the stomach and duodenum, offering less resistance to their own abnormally increased secretions, augmented by those of the liver and pancreas, than does the intestinal tract to the entrance of this material into it from these organs, give way before the force thus accumulated, and distension with inability to empty themselves is the result; that the history of the case herein reported, tends to demonstrate the fallacy of the widely accepted theory, that mechanical obstruction of the duodenum, alone is responsible for the phenomena connected with acute postoperative dilatation of the stomach.

TREATMENT OF ECLAMPSIA

By LEIGH F. WATSON, M. D., Oklahoma City, Oklahoma

ECLAMPSIA is to-day one of the most serious diseases encountered by the general practitioner and obstetrician. Regardless of the rapid strides made in other branches of obstetrics, eclampsia continues to show a high mortality outside of the practice of a few obstetricians and institutions where it has been the subject of careful and systematic study.

Zweifel has aptly termed it "the disease of theories." Williams says eclampsia is a form of intoxication with whose nature we are as yet unacquainted.

Jacobson believes eclampsia is only a form of uremia due to the nephritis and is caused by the retention in the blood of the salts (principally sodium chloride) which the damaged kidneys are unable to throw out, in sufficient quantity, with the urine. He further states that the retention of salts increases the molecular concentration of the blood and the symptoms of eclampsia follow.

After the sixth month the urine should be examined once a week and earlier, if edema of the eyelids or extremities or other signs of renal insufficiency appear. At the first sign of renal insufficiency a rigid salt free diet should be prescribed.

Williams, in a personal communication, states that premature labor should be induced if the albumen content rises and the urea content diminishes in spite of a suitable eliminative treatment and a rigorous milk diet. The presence of ten grams of albumen per liter as deter-

mined by Esbach's method in itself justifies resorting to radical methods, as in the majority of cases where this figure has been exceeded convulsions have subsequently followed.

Hirst says if the blood pressure is carefully observed and regarded as an invariable index of toxemia in the latter half of pregnancy when over one hundred and fifty, and if pregnancy is interrupted if it is impossible to reduce the blood pressure below one hundred and eighty by a rigid antitoxemic regimen, eclampsia can almost always be prevented.

Alcohol should be avoided by patients threatened with eclampsia becauses it reduce the oxidizing power of the cells as well as impairing the function of the vital organs.

Harrar states that beginning with February the number of cases increases during March, reaching the highest point in April, and then diminishes, until November, when it is at the lowest level.

McPherson in a series of two hundred and fifty cases ound the greatest number to occur in February and March and the fewest in December and January.

In 46,252 cases on the outdoor service of the Lying-In Hospital eclampsia occurred 1 in 1075, while on the indoor service in 14,899 cases it occurred 1 in 60. Eclampsia in this series was twice as frequent in primiparæ as in multiparæ, the youngest was 15, the oldest 48, while the majority of cases occurred between 20 and 25.

Eclampsia occurred antepartum in 57 per cent, intrapartum in 6 per cent, and postpartum in 34 per cent.

The symptoms of eclampsia are so well known that they will not be considered here. The convulsions are usually preceded by an aura which if recognized will save valuable time and enable the obstetrician to institute eliminative measures before the onset of convulsions. In one case impending eclampsia was diagnosed two hours before the first convulsion by the restlessness, rolling of the staring eyeballs, followed by black spots before the eyes, an occasional twitch of the eyelids and finally complete blindness which was soon succeeded by a general convulsion. In the meantime eliminative treatment had been instituted and the patient prepared for an operation; at the onset of the first convulsion Cæsarean section was performed. She received the usual eclamptic treatment and convulsions did not recur.

The pathology of eclampsia, according to Welch, pathologist to the New York Lying-In Hospital, is as follows:

The body and extremities usually show edema; brain, usually congestion and edema, and occasionally hæmorrhages; liver, light or grayish yellow, usually enlarged with extensive subcapsular hæmorrhages and degeneration of parenchyma; kidneys, extensive parenchymatous degeneration and occasionally subcapsular hæmorrhages. The thyroids in his cases were normal histologically, this has been described as a cause of eclampsia by a few writers.

The hæmorrhages are due to thrombosis and embolism. Welch has demonstrated thrombi in the large vessels of the liver and detached liver cells free in the blood-vessels. The thrombi have their origin in fused blood plates or agglutinated red blood cells. The emboli form from detached thrombi, detached liver cells, or giant cells from the placenta.

Welch believes that the most important cause of hæmorrhage is a solution of the lining endothelium of the capillaries and small blood-vessels and in some cases even the walls of the medium sized vessels. He says that the increased blood pressure is an insignificant factor in the production of hæmorrhage, there must first be an autolysis, due to the action of the ferment on the vessel wall, as occurs in the liver.

In no disease is prompt, thorough, and persistent treatment more important. No single procedure or drug can be depended upon to effect a cure. Expectant treatment is never indicated nor justifiable, besides it may cause the loss of mother and child.

First of all control the convulsions and institute measures to prevent their recurrence by removing the cause and at the same time empty the uterus.

For the control of convulsions, Williams states that ether is theoretically preferable to chloroform. A few teachers abroad have advocated controlling the convulsions with morphine and chloral and leaving the pregnancy to take care of itself.

In fifty per cent of the cases the convulsions cease after delivery. Eclampsia is always more serious in multiparæ than in primiparæ.

Administer morphine one-eight to one-quarter grain with hyosine one two-hundredth to one-fiftieth hypodermically and repeat every two to four hours as required to prevent recurrence of convulsions.

To prevent cerebral hæmorrhage and soften the pulse give one-hundredth to one-fiftieth grain of nitroglycerin or ten to fifteen minims of veratrum viride every four hours until the pulse is reduced to eighty beats per minute.

Elimination of the toxins is obtained by venesection, diaphoresis, diuresis, and catharsis.

Of any single measure to prevent the recurrence of convulsions, venesection is the most important From five hundred to one thousand cc. of blood should be removed, depending on the condition of the patient and the strength of the pulse. Following the venesection I inject into the vein five hundred to one thousand cc. of a sodium bicarbonate solution (one dram to two pints) at a temperature of 120° F. Recently I have obtained excellent results with the sugar water solution (one dram to two pints) intravenously at a temperature of 120° F.

Serious results often follow the use of too much solution intravenously. I believe that more than one thousand cc. should never be injected at one time, it is safer to repeat the procedure in four to six hours if the patient does not improve.

Diaphoresis is best obtained with the hot pack applied until free sweating occurs, usually fifteen to thirty minutes is sufficient. It should be discontinued at once if the patient shows signs of exhaustion. It can be repeated every two to four hours as required. Drugs to produce sweating, as pilocarpine, should be avoided because of their depressant properties.

Diuresis is promoted by the hot pack, hot rectal irrigation, and hot intravenous solution. When the patient is not in the pack, hot water bottles should be applied to the kidney region. The value of decapsulation it not yet proved in these cases.

After kidney function is restored give ten to twenty grains of potassium citrate every four hours to increase the amount of urine and aid in the elimination of the toxins.

Free catharsis should be induced as soon as possible with croton oil one to three minims in a teaspoonful of olive or castor oil or elaterin one-eighth to one-quarter hypodermically. The hot rectal irrigation at 120° F. should be used at frequent intervals.

Jacobson has obtained the best results by treating eclampsia with a continuous rectal instillation of sugar water by the drop method continued until all symptoms disappear. One teaspoonful of granulated sugar is added to one quart of water and the solution kept at a temperature of 115° F.

It is important to exclude salt from the diet, Williams prefers an exclusive milk diet.

In eclampsia it is at times difficult to decide on the method of delivery because of the prematurity or lowered vitality of the child. If the mother has had several convulsions the child is usually dead. If alive and at term it is usually poorly developed, weak, and undersized.

Williams writes that after the onset of eclampsia he considers manual dilatation most satisfactory provided the cervical canal is obliterated and resistance is offered only by the external os. On the other hand, when the canal is obliterated and the internal os intact he has obtained most satisfactory results with vaginal Cæsarean section, which under the circumstances he considers superior to the classical section, except in the presence of contacted pelvis.

Manual dilatation of the cervix can be carried on simultaneously with the measures of treatment previously described by using Harris' procedure and following with Edgar's bimanual method until one or both feet can be grasped and a podalic version performed.

If the child is alive it is safer and quicker to completely obliterate the internal os bimanually before performing the version so there will be no danger of an incompletely dilated cervix delaying the delivery of the head, and the loss of the child from asphyxiation.

In choosing between high forceps and version, the more experienced the operator becomes the more often will he choose version. A properly performed version is not only quicker than high forceps but the absence of pressure trauma from forceps enhances the chances of the child. After delivery the uterus should be encouraged to bleed freely. It is usually necessary to remove the placenta and membranes manually.

McPherson recommends abdominal Cæsarean section as the operation of choice in elderly primiparæ with a small, narrow vagina and a long cervix with a tough unyielding os.

TRANSACTIONS OF SOCIETIES

JOINT MEETING OF THE CHICAGO SURGICAL, CHICAGO GYNECOLOGICAL, AND CHICAGO UROLOGICAL SOCIETIES

HELD FEBRUARY 3, 1911, WITH DR. JACOB FRANK, PRESIDENT OF THE CHICAGO SURGICAL SOCIETY, IN THE CHAIR

DR. CHARLES B. REED exhibited a number of pubiotomy needles.

The subject for the evening was a symposium on

TUBERCULOSIS OF THE GENITO-URINARY TRACT

Papers were then read as follows:

1. "Tuberculosis of the Kidney and Ureter," by Dr. Arthur Dean Bevan.
2. "Tuberculosis of the Tubes, Ovaries, and Bladder," by Dr. Gustav Kolischer.
3. "Tuberculosis of the Prostate, Seminal Vesicles, and the Epididymis," by Dr. Robert H. Herbst.

DISCUSSION

DR. L. L. MCARTHUR was asked to open the discussion. He said: Mr. President and gentlemen: In rising I would like to emphasize one or two points that have come to me personally very forcibly. First, the very strange fact that tuberculosis, like the acute infections of the kidney, is so inclined to be unilateral. When Brewer read a paper before the Surgical Society on the "Surgical Removal of Unilateral Acute Infection of the Kidney by Nephrectomy," I sought my pathological friends to find a reason for this phenomenon. They were unanimous in telling me that they knew no reason why this should occur. Clinically we find it to be true.

As to the diagnosis, Dr. Bevan has covered this subject very thoroughly and has emphasized the fact that though clinically unilateral, elsewhere in the economy there will be some tuberculous focus which is usually to be found; and that in the deadhouse a bilateral tuberculosis was practically always found. In searching for tubercle bacilli in the urine, those who have made the attempt know too well how many times the procedure may be necessary to be repeated before the organism will be discovered.

Again, as to the justification for surgical intervention in cases of tuberculous kidney, I wish to re-emphasize what I have once before called the attention of this surgical society to, viz. that neither the finding with the ureteral catheter, of a normal urine on one side, nor finding elimination of the phenyl-phloridzin in twelve minutes, nor the elimination of the indigo carmine in eight minutes, nor the finding that the total output of urine is sufficient, is yet sufficient evidence to allow us to decide that the kidney affected may be removed with impunity. In conjunction with a case operated upon with Dr. Eisendrath at the Michael Reese Hospital, this experience came to us so forcibly that if I can portray it to you I feel that I shall have done a service. On the left side we found a large kidney whose ureter gave us a purulent tuberculous urine. From the ureter of the opposite side we found a perfectly normal urine of proper specific gravity, of proper amount of urea. On operation on the left side for the trouble there we found a large kidney with very small amount of renal substance remaining. Death ensued from uremia and at the postmortem we found on the right side a tiny infantile kidney, perfectly normal, secreting normal urine.

Had we taken the functional capacity of this kidney we would have found not sufficient urine could be secreted from that side to maintain the patient. That patient lost his life because he did not have enough kidney tissue on that side. As to the question of nephrotomy in some of these tubercular kidneys, Dr. Rumpf sent to me a patient with an enormous septic kidney on the left side, the patient suffering with a profound sepsis, temperature of 104°. I am sure, had I attempted to remove that kidney the patient would have died, but a drainage of that kidney permitted a subsidence of the sepsis, and two or three months later the removal of a contracted, sacculated, tuberculous remains of a kidney permitted us to save the patient, so that nephrotomy in certain cases is a desirable procedure. I have been guilty of removing the entire ureter.

This at the time was the authorized surgical practice. I am willing now, based on the experience that the Mayos particularly have had, to leave the ureter and remove the kidney. I must say that I have been amazed to see twenty or thirty drops, or even a dram, of pure carbolic acid injected into the cut end of the ureter before its ligation, and dropping back into the wound. I like very much the suggestion of the reader of the first paper to bring the ureteral end into the wound where it can absolutely do no harm and where, if necessary, medication can be made. When one has a personal experience in curing symptomatically a case of tuberculosis of the kidney which has been sent to one for the removal of that organ, and has secured that cure by means of so simple a remedy as the injection of tuberculin, one is likely to become enthusiastic. I feel very strongly, however, the emphasis Dr. Bevan has laid upon the fact that by many other methods, by good antituberculous procedures, cases of incipient tuberculosis of the kidney will get well. I have had, nevertheless, as has Dr. Hektoen of this city, very gratifying results from tuberculin.

One year ago Dr. Favill sent me a case of tuberculosis of the kidney and bladder for the consideration of a nephrectomy or a nephrotomy. On investigation of the case it was found that not only had the patient tuberculosis of the kidney and bladder, but also of both epididymes, and the prostate, with numerous glands involved, convering the base of the prostate. The patient was a boy, nineteen years of age, who had wasted down from 126 pounds to 109 pounds. He was then put upon the systematic use of tuberculin after Wright's recommendation. That boy today, instead of urinating five or six or seven times during the night, and many times during the day, as he formerly did, can now sleep all night, and instead of weighing 109 pounds, he weighs over 142 pounds. He is going on with his winter's work in school, and nothing has been done for him in a surgical way other than to clean out the broken down abscess in the epididymis and to give him tuberculin.

In those fistulæ which remain after the extirpation of a kidney, I have been able to make them heal (when long-continued other surgical procedures had failed) by one or two injections of tuberculin.

Tuberculosis is sometimes associated with another organism, and will so bring the patient to death's door that one will despair of saving him, and yet I was fortunate enough in having an enthusiastic associate with me, Dr. Hollister, in this work, who, after I had given instructions that the patient should not be disturbed by any further surgical procedure, and should be given morphin and allowed to die, asked me if he might give a mixture of tuberculin and pyocyaneus vaccine (autogenous). Not seeing that any harm could come from it, and expecting the patient to die in a day or two, I assented. His enthusiasm carried him along to make a mixed vaccine, and this patient from having sacral ulcerations from bed sores, ulcerations on the heels; having no kidney on the left side and ureter on that side; having had tuberculosis of the bladder, and drainage of the bladder with cure of the bladder, but tuberculosis of the vagina; having had so much distress with tuberculosis of the vagina that I brought the remaining ureter out on the other side, from such a desperate condition has been restored to health, weighs 180 pounds now and is supporting herself by running a boarding house. The question of tuberculosis as a primary or secondary affair should be spoken of "clinically" as primary tuberculosis, and not considered on the technical basis that there might be some focus in some other part of the body. When all the symptoms of tuberculosis clinically attract attention to one part, and nothing is self-evident objectively or subjectively in other parts, then we should speak of tuberculosis as primary and understand the technical questions that may arise.

DR. DANIEL N. EISENDRATH: There were so many valuable points brought out in the papers read by Drs. Bevan and Herbst in which I am particularly interested, that it is impossible in a five minutes' discussion to cover all of them. There are several, however, I wish to emphasize. There are two forms of tuberculosis of the epididymis, the one form Dr. Herbst mentioned was the one with a relatively acute onset. These cases frequently fall into the hands of the general practitioner and are treated for weeks as cases of gonorrhœa until the diagnosis is made, at a time when there is already secondary involvement of the seminal vesicles and the prostate. It is this form of tuberculosis of the epididymis we ought to have more widespread knowledge of. These are the cases which, without being put on a gonorrhœal basis, run a course that seems to be very acute, with sudden onset of pain, swelling, and very frequently an abscess formation, with perforation externally into the scrotum within a period of six weeks or two months. I had one such case in a young boy who went to a military school out near Kansas City last summer a year ago, and was treated by the physician of

the school for six weeks under a diagnosis of gonorrhœa until the epididymis kept getting harder and harder and seemed to be more involved, which attracted his attention, and he sent the boy to the city.

In regard to another question which is of vast importance in the operative treatment of these cases of tuberculosis of the epididymis, I have had a personal experience similar to that cited by Dr. Herbst, with the tuberculin treatment, and I think in cases of advanced tuberculosis of the epididymes, the prostate, the seminal vesicles, and bladder, we certainly ought to keep them away from the operating table and treat them with general hygienic measures, and with the use of tuberculin, because they certainly get well with it.

There is another class somewhat related to these cases. There are certain cases in which we have removed the epididymis for tuberculosis, and yet there is extensive involvement of the prostate and seminal vesicles, where such an extensive operation as the removal of the prostate and seminal vesicles is out of the question. These are major operations, exceedingly difficult from a technical standpoint to perform, and such patients ought to be treated with tuberculin after the epididymis has been removed.

In regard to tuberculosis of the kidney, I have seen several such cases of the type that has been referred to briefly by Drs. Bevan and McArthur, namely, cases of mixed infection in which there is a combination of the tubercle bacillus and the colon bacillus, which runs more or less the clinical picture of acute pyelonephritis, of more or less sudden onset, with fever, high temperature of 103–4°, and it is not until the urine is careful examined under the possible suspicion of tuberculosis of the kidney that such a mixed infection is diagnosed.

There are several other points in regard to tuberculosis of the kidney that might be discussed. In the first place, there is a form of tuberculosis of the kidney which is not generally recognized, and that is the form in which the caseous foci are not in communication with the pelvis of the kidney for a long time. These cases are called the closed tuberculous pyonephrosis. Dr. Hessert at a meeting of the Chicago Surgical Society showed a beautiful specimen where the upper half of the kidney was occupied by a large tumor-like mass, with considerable caseation, with absolutely no communication with the pelvis of the kidney, and in which the suspicion of involvement of the kidney was only on account of a constant moderate degree of temperature. But there were no tubercle bacilli found in the urine.

One point that Dr. Bevan mentioned in the differential diagnosis of tuberculosis from stone and from carcinoma is interesting. I had occasion to see a radiograph from a case of Dr. McArthur's at the Michael Reese Hospital, where the caseous focus gave as typical a shadow of stone as a genuine stone would do, and I think that is a point we have to bear in mind, namely, that partial calcification may give a very intense shadow, and we must remember also this: we may cut down upon a kidney in which a diagnosis of stone has been made, and find it tuberculous, because so frequently, or in a relatively fair number of cases, there exists a combination of tuberculosis and stone. But there is one point especially I think ought to be emphasized for the benefit of the general practitioner, and that is in connection with tuberculosis of the kidney, in addition to the increased desire to urinate which these patients have, the attention of the general practitioner ought to be turned towards the kidney and the possibility of tuberculosis of the kidney in every case when there is pus in the urine which cannot be benefited by the ordinary methods of bladder or urethral treatment.

Dr. William T. Belfield: About a year ago several excellent surgeons in this city were consulted individually by a man, twenty-six years of age, whose condition then was essentially this: He had already had one testicle removed for tuberculosis; the epididymis remaining was very large and hard, and there were three or four discharging fistulæ. The cord on that side was very large. Both seminal vesicles and prostate were nodular. He was urinating every two hours or less. The urine contained some pus and tubercle bacilli. He was ten pounds under his normal weight and was running a daily temperature. The treatment advised was surgical; one of the gentlemen advising removal of the remaining testicle; one advised removal not only of the testicle and cord, but also of the seminal vesicles and prostate, and every thing else portable that might be found in that vicinity. The young man did not take kindly to that advice; he drifted around to others of lesser note, and ultimately reached my office. That man to-day, about a year afterwards, is as well as he ever was, and weighs more than he ever did. There is no pus nor tubercle bacilli in the urine, and no bladder irritation. The epididymis fistulæ are healed, its size much reduced, and he has taken three milligrams of old tuberculin as a test without reaction. The treatment given was hygiene, guiacol, and tuberculin.

I have been using tuberculin in the treatment of genital tuberculosis in the male for about five years, in several dozen cases. I have not cured all of them; but I have reached this firm conviction, namely, that no case of tuberculosis of the male genital tract should be submitted to mutilating surgery until tuberculin has been faithfully and intelligently used.

So far as the urinary tract is concerned, the outlook, according to my limited personal experience, is not quite so favorable. Nevertheless, if I had tuberculosis of the urinary tract, I would certainly not submit to any surgery until I had had tuberculin and hygiene tried.

Dr. William Fuller: I do not lack confidence in the operative skill and ability of the members of this society, but before I could submit to a nephrectomy at the hands of any of them, I would not only desire to know or to be assured of the actual existence of an advanced unilateral renal tuberculosis, but I would wish to know also that the disease did not exist elsewhere; and that the second kidney possessed to the fullest extent, its normal functional capacity.

During the past few years we have witnessed a decline in the popularity of nephrectomy or other radical interference in renal tuberculosis. This is due to two good reasons: First, the realization, more now than ever before, that we can not always, if ever, be certain as to the state of the other kidney; the methods for determining which, are often misleading and give us, sometimes, the same picture so well shown by the case illustrated by Dr. McArthur. We may figure a death rate in nephrectomy for kidney tuberculosis, not upon the operation, but upon our failure or inability to estimate the future work necessary in the remaining kidney. Secondly, we recognize more than ever, the great value of hygienic, climatic, and other forms of non-surgical treatment, in genitourinary tuberculosis.

In advanced tuberculosis of one kidney, with an absence of this disease in the other kidney, as well as elsewhere in the body, total removal of the diseased organ offers, of course, the only hope of a speedy and certain cure. Surprises, however, are many when we proceed with an attempt to surgically deal with a tuberculous kidney; its appearance, when exposed, may not present the condition as generally seen in this disease; its condition may appear normal, the surface shiny and free from nodules. If such a kidney is laid open and examined closely, evidence may be obtained that will negative the indications for total extirpation of the organ. Such cases are met with: I have operated on one, and have knowledge of a second one in the hands of another surgeon. When a kidney is laid open in the manner described and fails to disclose at once proof of tubercular disease, that kidney should not be removed at all. If the disease, after this step, is found to involve one part or one pole of the kidney, a removal of this portion of the kidney is all that is called for. Nephrectomy then, as for stone, and resection have a place, not definite of course, but a place in renal surgery for tubercular disease.

Tubercular adenitis of one or two lymph nodes in the neck does not call for a wholesale removal of all the glands on that side. We do not resect a joint for a local or single focus of tuberculosis in the joint, nor is it wise to amputate the limb for such a lesion. It has been shown that the ureters have healed after removing the diseased kidney, although it seems unsurgical to leave them in situ, especially when they are tuberculous. Tuberculosis of the kidney, is, generally, widely disseminated, and calls, therefore, for entire removal of the organ; but to say that this is always so, is as untrue, as routine surgery is unsafe.

Dr. Louis Wine Bremmerman: I had not the good fortune to be here in time to hear Dr. Bevan's paper, but I have had the pleasure of receiving several of his reprints on this subject and am fairly familiar with his ideas regarding it. I heard part of the paper of Dr. Herbst, and also a part of the paper of Dr. Kolischer. There are one or two points I would like to bring up, first emphasizing the remark of Dr. Herbst in regard to early diagnosis, and I think it depends upon the general practitioner very largely. The surgeon and specialist see cases of urogenital tuberculosis, after they have progressed to a considerable degree, many times too late for surgical interference. I believe if the general practitioners, specialists, and surgeons would instill into the minds of patients the advisability of coming to them for examination once or twice or more times a year when they are well, not wait until they are sick, many times we would recognize early tuberculosis before the symptoms are so marked as to bring the patient to us for that particular trouble when he or she, as the case may be, has frequency of urination attended with pain, blood and pus in the urine, and extension of the disease, involving a considerable amount of tissue and structures. When a patient has pus or blood in the urine, a middle aged or young adult, and the pus and blood have extended over a long period of time, and will not clear up with the ordinary means of treatment, I think we should, first of all, suspect tuberculosis, and the

urine should be examined carefully for tubercle bacilli. This examination is a difficult one, and many times general practitioners and surgeons have not the time to make this examination themselves and they must trust it to the laboratory. But they must see that the laboratory reports are accurate. Many times as many as twenty slides are necessary in examining specimens in cases of suspected tuberculosis, and these should be checked up by guinea pig inoculations.

As to the surgical treatment of these cases, I am very much of the opinion that early diagnosis, with complete extirpation of the localized focus, is the proper procedure, followed by tuberculin treatment. If we have such glowing reports from the progressive cases of tuberculosis involving both kidneys and bladder, as well as the lower genital tract responding to the tuberculin treatment, why not give it in all cases and discard surgery entirely? Is it not reasonable to suppose that a patient with a localized area of tuberculosis in the kidney, unilateral, will respond to tuberculin treatment much more readily than a case involving all the tissues which I have mentioned, or a great part of them? My experience with tuberculin has been limited. I have had one or two cases in which it seemed to bring about a dramatic result, that is, a beneficial result, but I am not sure it has produced cures. We will have to wait. I believe we are on the verge of an epoch in vaccine treatment, and that tuberculin probably will come in and form a very important place in our therapy, not only for tuberculosis, but for other infections of the genital tract. I believe these cases of copious hematuria in the young, as a rule, should be looked upon as tuberculosis until they are proven to be other conditions. I have had one case under my observation where a copious hematuria occurred two years ago, the patient was treated symptomatically by quite a few physicians and surgeons here in Chicago, and it was left to the good graces of a Chinese doctor to cure the hematuria by giving a decoction of some horrible, terrifically odorous fluid, which stopped the hematuria. About two months ago this patient came under my observation showing marked hematuria from the right kidney. I suggested at this time nephrectomy as I suspected tuberculosis. The patient refused the operation. He went for three or four weeks without treatment. The hematuria continued from this time. When he finally consented to operation the hemoglobin was 35; the kidney removed showed tuberculous conditions, guinea pig report following inoculation came a week after the operation verified the diagnosis of tuberculosis of the kidney. In these long standing cases of hematuria and pyemia, as Dr. Eisendrath has said, in young adults, tuberculosis should be suspected and careful examination instituted before we arrive at any definite conclusion regarding diagnosis.

Dr. A. Belcham Keyes: I think the pendulum is swinging a little too far the other way. I want to put on record the case of a woman, fifty-nine years of age, with tuberculosis of the peritoneum, probably originating from the tubes or the appendix. The tissues were so absolutely rotten that I could not ligate the appendix, as everything tore away, but after covering the parts in as nicely as one possibly could, after the removal of the appendages from the uterus and the vermiform appendix, and clearing up the bladder entirely under ordinary hygienic treatment, without the slightest medication whatever, that woman has made a perfect recovery. The physician who brought this case in consultation was a man of wide experience, and the result has been so satisfactory in such an advanced case that I thought it would be worth while to report it. Tuberculosis in some of these cases is not so hopeless a disease as we have thought heretofore.

Dr. A. J. Ochsner: The subject of tuberculosis in every portion of the body has become so hopeful from a practical standpoint that it seems to promise a very interesting and profitable evening to have the various phases of the subject of genitourinary tuberculosis treated by the men who have had the greatest amount of experience in all these departments, and I am sure that we have all profited by what has been said. The fact that so large a proportion of patients suffer from pulmonary tuberculosis, from bone and joint tuberculosis, from tuberculosis of the peritoneum, and from glandular tuberculosis, that formerly were practically certain to die as the result of secondary tuberculosis, now make a permanent recovery, indicates that in the three fields under discussion we must look for some satisfactory results, provided we approach the treatment of cases suffering in these fields from the same standpoint. This has been brought out to-night so fully that I will simply emphasize these methods, namely, that whatever we do in these cases we must put the patient in a condition from which he is compelled to fight only this one infection. That is, we must dispose of the other infections. So long as a patient is suffering only from tuberculosis he has a very fair show in the world. When he suffers only from this one infection, the use of a vaccine has been proven to

be of enormous importance. It has been so in our own observation and experience. The greatest thing we can do for these patients is from the standpoint of hygiene and nutrition. If we look after these cases precisely as though we were not surgeons, our patients would have a great deal better show than if we were simply surgeons. The surgeon who is only a surgeon has no business to treat tuberculosis, because he is sure to do the patient more harm than good. If he is not a mighty well posted diagnostician, and if he is not mighty well posted in regard to what can be done for these patients from the standpoint of hygiene and nutrition, then he has no business to treat surgical tuberculosis, because he will do his patient more harm than good. Cases of tuberculosis of the kidney in whom nephrotomy had been made, who have come to us during the last three years with sinuses, have done so remarkably well with the hygienic dietetic treatment, with the addition of the injection of Beck's bismuth paste into these sinuses, that I am not so certain of the fallacy of nephrotomy in tuberculosis of the kidney as I was before. I was so strongly convinced of the preference of nephrectomy in all cases of unilateral tuberculosis at that time, that it was difficult for me to change my mind, but I believe that nephrotomy now has a very distinct place since Beck's paste was introduced into this field of work.

Regarding tuberculosis of the tubes, I made a very interesting observation in connection with the use of Beck's paste, which has nothing to do, however, with the treatment of tuberculosis. For several years we have tamponed the cavity of the uterus with gauze saturated with Beck's bismuth paste, after curettement, in cases of chronic endometritis, where the uterus and tubes were infected.

Some time ago, after curetting a case, and tamponing the cavity of the uterus, and opening the abdomen for further operative treatment, I found this paste in the peritoneal cavity in the cul-de-sac, and it occurred to me that I might have perforated the uterus, but picking up the end of the tube I found it oozing from the end of the tube, so that there was evidently paste transported from the cavity of the uterus into the peritoneal cavity; in other words, the paste that had been introduced into the cavity of the uterus on this gauze had been carried into the peritoneal cavity through the Fallopian tubes. I have observed this many times since then, because I always look for it now, so that this transfer of paste from the uterine to the peritoneal cavity can be accomplished in the short interval between tamponing the uterus and opening the peritoneal cavity. This observation seems to explain how the method of infection would look as in cases of tuberculosis of the tube in patients perfectly healthy before marriage whose husbands had a tuberculous epididymitis.

DR. BEVAN (closing the discussion on his part): I feel that in saying what I did in regard to the prospect of cure in kidney tuberculosis by hygienic management and possibly the addition of tuberculin, that I was going very far and giving the hygienic management and the tuberculin a great deal of credit, even possibly more credit than they deserved. There seems to have been to-night a swinging of the pendulum toward this direction, and I must say altogether farther than it is warranted by the facts. The hygienic management and possibly tuberculin will succeed in curing a very limited number of cases of tuberculosis of the kidney. The evidence upon this point is certainly very conclusive with our present data. If one goes over the literature of the subject carefully and reads it up to date, I think he must be convinced of this fact that kidney tuberculosis is usually unilateral, that it invades the kidney so widely that no resection is ever of any benefit, the examination of the pathological specimens which I have passed around makes that clear, and they are good samples of what you will find in actual work; that when the condition is discovered early, the removal of the kidney gives the patient beyond any question of a doubt the best chance for a cure. I have done in the neighborhood of thirty of these operations, nephrectomies for tuberculosis. We have had three deaths in that series, two in extremely difficult cases of nephrectomy secondary to a nephrotomy. There is no doubt but what these results cannot be approached for a moment by medical management and tuberculin, or by any other management that has ever been suggested up to the present time. In other words, I want to emphasize the fact that nephrectomy for unilateral tuberculosis is one of the great triumphs of modern surgery; that it is one of the means of curing patients which stands out in a very marked and prominent way, and I do not like to see the other side, the reaction against radical surgical treatment, made too strong. The facts do not warrant it.

I would like to emphasize again the fact that I believe that in tuberculosis of both kidneys or of a single kidney, when there is involvement of other tissues, that the medical management and tuberculin may prove the best method to adopt, and that I do think that these cases are entirely

hopeless; but I do not like the suggestion of nephrotomy and the use of Beck's paste as a means of curing tuberculosis of the kidney. I do not like resection. If nephrotomy has any field at all, it is very limited, such cases as the case cited by Dr. McArthur, which is the exception, and not the rule. I want to repeat that the early recognition of these cases, and particularly the radical removal of the focus, gives the patient beyond any question of a doubt the best prospect of cure from tuberculosis of the kidney..

DR. KOLISCHER (closing the discussion on his part): I think Dr. Bevan included me among the over enthusiastic in the use of tuberculin, but I do not want to be misunderstood.

I do not think any reasonable man who uses tuberculin will go any farther than I have stated. It was admitted that tuberculin will cure certain cases; now if tuberculin is useful, let us say in ten cases out of a hundred; in as long as we are not in a position to determine definitely whether we are going to cure case number one or case number eleven, is it not wise to give the tuberculin a fair test in every case, before we resort to mutilating operations? Of course it is understood that all urgent surgical interferences will take place at the same time. Resection of the kidney for tuberculosis does not appeal to me as the outcome of sound surgical reasoning. Firstly, how is one going to determine after he has cut open a kidney whether there is only one tubercular focus present or a thousand of them. That cannot be done at the time of the operation and could only be decided by serial microscopical cuts. Secondly, we know that any attempt at an exsection out of a tubercular parenchymatous organ would expose the patient to the great danger of disseminating the tuberculosis.

As to the use of bismuth paste my experience with it is only a limited one, but a decidedly discouraging one as to its curative effect in tuberculosis. I certainly would hesitate to inject such a toxic substance as it proved itself to be into a kidney or a sinus resulting from a kidney operation. I am glad to state that the discussion showed that the majority of surgeons are recognizing now the fact that cystoscopy is a necessary aid in dealing with bladder and kidney diseases. It was a hard fight, but it has been won. At the same time I would like to caution against excessive assurances. I am for twenty years an enthusiastic exponent and a strong advocate of cystoscopy, but on the strength of my experience I want to state that we cannot expect that the cystoscope and the ureteral catheter can accomplish all that is told us from certain quarters. I want expressly to state at the present time there is no reliable method known of determining the so-called functional capacity of the kidney. All the enthusiastic reports on the indigocarmin test, on the phloridzin test, and so on, prove only a fact, anyhow well known, that is, that every father loves his own child. Unfortunately at the present time we cannot predict with any certainty what a kidney will do after its mate has been removed out of the body — we are simply taking a chance.

CORRESPONDENCE

EDITOR SURGERY, GYNECOLOGY AND OBSTETRICS:

My attention has been called to the fact that the method of finishing the button-hole stitch which I described and figured on page 78 of your January issue has been published before in at least two text-books—Cheyne and Burghard's "Manual of Surgical Treatment" and Rose and Carless' "Manual of Surgery." In the latter volume, it is stated that the method was "originally suggested by the late Mr. Maunsell." I regret very much to have occupied your space with a reinvention; but I had no knowledge that the method had been used by any one before. Thanking you in advance for inserting this letter, I am

Yours sincerely,

J. J. BUCHANAN.

Pittsburg, Pa.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF SURGERY

UNDER THE CHARGE OF

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DIAGNOSIS AND TREATMENT OF NEPHROLITHIASIS

ABSTRACT PREPARED BY C. G. GRULEE, M. D.

(From article by Björn Floderus, *Nord. Med. Archiv.*, 1910. xlii, afd. 1 (Kirurgi), h. 4, No. 6; 1910, xliii, afd. 1, h. 1 and 2, No. 1).

SYMPTOMS

Before active symptoms a latent period exists, its length being dependent upon the position, movability, form, and growth rate of the stone, and upon the presence of infection in the kidneys. Latent nephrolithiasis is present in about 1.5 per cent of all patients (Middlesex Hosp. Rep., 1885-1895).

A stone a few millimeters in diameter may produce hematuria, and one about half the size of the kidney may show no symptoms. Stones of small volume, light weight, smooth surface, and immovably fixed, as in one of the calices, are most likely to remain latent.

Subjective symptoms. Pain most often leads to calling the physician. The character of the pain is quite various. It may be a dull ache or a sharp lancinating pain referred to testicle or vulva. If the pain is strong, cutting and colicklike, we may suppose that the stone has just entered or is in the canal of the ureter. Colicklike pain can, however, be produced by blood clots and by stenosis of the ureter, through fold formation. The pain is sometimes accompanied by spasm of the cremasteric muscle or by painful erection with hæmorrhagic pollution.

Pain can be referred to the leg, gluteal region, and back. The localization of the pain allows us to draw no conclusion as to the position of the stone. The nephrolithiasis colic comes when the stone passes into the ureter, and is caused by the spasmodic peristaltic action of the tube and stagnation of the urine, with resultant distension of the kidney pelvis. The colic may be accompanied by collapse or may simulate a peritonitis. The duration is usually one or more hours, but occasionally with remissions they last several weeks. Sometimes these are accompanied by almost continuous micturition of a few drops at a time. When the stone passes into the bladder all pain ceases at once, the patient urinates freely and frequently goes to sleep. If the pain ceases gradually, the stone probably remains in the ureter.

Differential diagnosis. A great many "néuralgies rénales" have their origin in renal calculus. Rheumatism may be diagnosed, or the testicle or ovary may be removed to relieve the pain, which in reality is caused by a renal calculus. Appendicitis not infrequently causes difficulty, especially since recently a number of cases of pyelonephritis due to an infection extending up the ureter from an adherent appendix have been recognized. Stones in the gall-bladder and pancreas, and gastric and duodenal ulcers must all be taken into account, also salpingitis, tubal pregnancy, and adhesive pleuritis. Kidney tumors, renal tuberculosis, especially if small clots of pus clog the ureter, may cause difficulty. Auschmann has described multiple emboli of the kidney as a possible source of error.

A characteristic of the pain of nephrolithiasis is that it is greatly exaggerated by strong movement of the buttocks. This is probably brought about by forcing the stone against the opening of the pelvis, thus producing congestion of the kidney and distension of the pelvis. Morris has reported 28 cases illustrating the sources of error, and Tenney, 32.

Objective symptoms. Hematuria occurs frequently in attacks brought on by body movements. Not so much the size of the stone as the position, form, and degree of hardness play the chief rôle in hematuria. This varies greatly in amount and duration but rarely leads to any great degree of anemia.

Usually on careful examination some blood can always be found in the urine. Most typical is that after bodily exercise some blood can distinctly be seen in a previously clear urine. If a pyonephrosis exists with nephrolithiasis it is quite typical that after a longer or shorter period of pain and general sickness there is suddenly discharged a large amount of pus in the urine.

In contradistinction to nephrolithiasis, the hematuria of kidney tumors is apparently without cause, while that of renal tuberculosis is of shorter duration. The hematuria in movable kidney is often more difficult to differentiate.

Stone in the ureter is more frequent that was formerly thought. There may be several stones present. The condition is more frequent in men in proportion of 3 to 2, the majority of cases occurring between the ages of 20 and 60 years.

Oliguria may be due to the plugging of the ureter with a stone. If the lumen is not completely closed the result is often a hydronephrosis sometimes of considerable size. Should this latter become infected, a more serious condition, pyelonephrosis, confronts us. Of much greater gravity is the reflex anuria. According to some authors (Kümmell) this occurs only if the now obstructed kidney is diseased. The condition, however, is not common, and only a few well authenticated cases are found in the literature. Pure reflex anurias are rare. The majority of the cases in the literature are doubtless due to defective kidneys, such defects caused perhaps by the sudden pathologic changes produced in the otherwise normal kidney by the failure of a nephrolithitic kidney to functionate properly. From a practical standpoint it makes little difference whether the other kidney is diseased or not, the condition exists and must be met. In anuria the condition becomes gradually worse and in a week or may be three or four weeks uremia develops. Only a small proportion of untreated anuria cases recover.

All factors which predispose to the stagnation of the urine, such as hydronephrosis, movable kidney, and kidney cysts, predispose to renal calculus.

Infection frequently clouds the picture of a nephrolithiasis and is of grave moment. This infection frequently ascends from the bladder. Pyuria in nephrolithiasis may not always mean pyonephrosis, but may be an infection of other parts of the urogenital canal. Sometimes paranephritic abscesses develop.

Occasionally a stone ulcerates through the ureter. Rarely tuberculosis of the kidney complicates renal calculus. No distinct connection between stone and malignant kidney tumor has been noted.

DIAGNOSIS

Of late years the possibility of making a certain diagnosis of nephrolithiasis has greatly increased with our more advanced methods of examination, such as the X-ray and ureteral catheterization.

Palpation. On palpation crepitation of the stones may be felt or the stone itself may be felt per vaginam or per rectum. In rectal examination even if the stone itself is not felt the swollen ureter may be, and hence show on which side the stone is located. Floderus does not take up the other means of diagnosis, such as urine analysis and cryoscopy, but only cystoscopic and X-ray examinations.

Cystoscopic examination. In the normal bladder the difficult thing is to get a good view of the ureteral orifices. This is possible about one to three times a minute due to the rhythmical peristaltic contraction of the ureter. At first the submucosa bulges, then the orifice opens, and urine is ejected into the bladder.

If a stone is present in the ureter rarely the cystic orifice may be widened, often surrounded by a catarrhal inflammation. If the stone is higher up edema may be present. We must always remember that other pathological conditions in the kidney may produce like symptoms. Through the cystoscope it may be determined that the contractions of the ureter are irregular, the single ejections becoming weaker and less voluminous on the affected side.

Ideas as to the amount of urine passed by each kidney and the nature of this as well as the functionating power of each kidney, may be obtained by methyl blue or indigo carmine test. Occasionally blood clots are seen at the ureteral orifice. In hematuria the cystoscopic examination is frequently of much value in determining the kidney affected, since the introduction of a ureteral catheter into an inflamed ureter may cause hæmorrhage. In pyelonephrosis pus can often be recognized when passing into the bladder.

By ureteral catheterization one can determine almost absolutely the functional possibilities of each of the two kidneys. If one meets an obstruction this may be due to fold formation or spasm. To prevent the latter, it is well to advance the catheter only during the period of relaxation of the ureter. At times introduction of the catheter may cause a transient albuminuria or hematuria, usually, however, the urine is large in amount and poor in total solids. Very rarely anuria of a reflex type of perhaps an hour's duration may follow ureteral catheterization. The catheter may at times pass the stone and go on into the pelvis. The dangers of catheterization are principally those of perforation of an ulcer and of infection. Kapsammer prevents the latter by injecting 4 cc. of a 1 per cent silver nitrate or 1 per cent sublimate solution into the bladder before catheterization, a procedure which is absolutely painless.

If the ureteral sound becomes impacted with a stone in the ureter, it should be allowed to remain 24 hours, after which time it can be readily removed. Sometimes the scratch of the stone against the catheter can be felt, or an impression scratch made on a wax or metal tipped sound, or the scratching heard by means of a phonendoscope.

Therapeutically, catheterization may be of value for washing out the pelvis of the kidney, for relieving an anuria, or for widening a ureteral stricture.

X-ray examination. This should be entrusted only to a man with much experience and ability to interpret X-ray pictures. There follows here a short history of use of X-ray in nephrolithiasis.

During several days previous to taking picture no drug containing metallic substances should be given and laxatives should be administered, usually castor oil, two teaspoonfuls on the day before. On the day of examination the patient should eat only milk, gruels, and eggs. Restless persons should be given a sedative. The room must be warm, and the abdomen bare.

The patient is placed on the table with hip and knee joints flexed. The abdomen is compressed with a bandage between which and the skin is a pneumatic rubber pouch. In old persons and women with stiff flat thorax this latter can often not be used.

The picture should include the whole urinary system. Usually the tubes must be medium hard, but for small stones or those of low specific gravity a soft tube and short exposure is best. Injection of oxygen into the bladder (thence into kidney pelvis) gives a clearer picture (Frank). A metal wire introduced into the ureteral catheter is sometimes of use. In this case error may occur through the position of the stone in a ureteral diverticulum. This might be overcome (Voelcker and Lichtenberg) by injection of five per cent collargol solution into pelvis of kidney.

Radioscopy is of little importance except to determine if a stone is overshadowed by the rib. A radiogram to take in the kidneys must include the last rib in each side and the lateral processes of the three upper lumbar vertebræ. Usually the contour of the kidneys shows sharply only in the lower part. The contour of the kidney can be changed by various diseased processes, and if the kidney be greatly degenerated there may be no kidney shadow.

Before taking up the radiograph Floderus discusses the formation and development of the stone. The uric acid infarct of the newborn is probably the source of many of the stones found in earlier life. Small concrements are frequently found in the swollen calices of the kidney and produce stagnation of the urine, thus gaining size by external accretions. This is also true in cystic or hydronephrotic kidneys. If the space be large enough for the stone to be freely movable it is usually spherical or oval. The stone may completely close the ureter or act as a ball valve, producing a hydronephrosis in which case the stone may grow to much greater size than is usual. Through the sclerosing of the kidney the latter may become simply a sac enclosing a large calculus. If there is infection and the urine as a consequence becomes alkaline the stone usually increases greatly in size, the primary stone being of uric acid, urates or calcium oxalate, the secondary or added concretions being of phosphates.

Radiogram of renal calculi. Stones in the calices have their position as a rule one-half cm. within the convex border of the kidney. If any stone be nearer the surface than this there is grave suspicion of some distinct degeneration of the kidney, such as a cyst formation in circumscribed hydronephrosis or suppurative process. If the shadow is round or oval then in all probability the stone is movable; if three cornered it is likely at the orifice of the ureter. Even though the contour of the kidney is not to be seen in the radiogram through the position of the stone, it is often possible to tell fairly accurately the position of the stone by its relation to other structures. One should not, however, draw too definite conclusions from these alone. It is often possible by these means to draw fairly accurate conclusions, however, as to what the nature of the operation will be. It is sometimes possible to diagnose disturbances of the kidney, such as hydronephrosis, pyonephrosis, or horseshoe kidney, by the position of the shadow in the radiogram. If the shadow is sharper than usual, it always gives us suspicion that the kidney is bound tight to the posterior wall by adhesions. Other things equal, ureteral calculi give sharper shadows than do renal. A careful study of number, position, size, and form of the urinary calculi, as shown in the radiogram, may be of great assistance to the surgeon in determining the kind and extent of the operation to be undertaken.

Radiogram of ureteral calculi. The ureter is narrowed 4 to 5 cm. from the pelvic orifice, at the point where it crosses the vessels and at the vesical opening. These are the natural places for the stone to lodge. The danger of anuria is far greater if the stone be lodged at the upper narrowing. Only exceptionally are stones found in the ureter itself, and when there the chance for accretions is less than in the renal pelvis. Each stone has a tendency to enlarge centripetally and so become elongated, unless it lies at the upper or lower opening with one end in the kidney pelvis or bladder, in which case there is a process to fit the ureter and a broad portion in the pelvis or bladder, the covered surface being smooth, the uncovered rough.

Sources of error in radiograms. In the urogenital system many sources of error may arise. Tuberculosis may cast a shadow but it is scattered and often at the periphery of the organ. Scars or diverticula of the ureter or diverticula of the bladder may prove confusing. The form, size, and position of the vesical calculus are usually sufficient to differentiate this. Concretions in the prostate or the vasa deferentia may present difficulties.

Feces in the colon may cast a shadow and prove very deceptive, especially if foreign bodies, such as cherry stones, be present. Bismuth given per orem may also cause difficulties. The appendix may cause a shadow on the plate and from its position be confusing. As a rule gall-stones do not

give a shadow, but if they do it is impossible to differentiate them. The same may be said of pancreatic concretions.

In the vessels arteriosclerosis and phleboliths may cause some difficulty, as also may calcified lymphatic glands. Other rare sources of error which may be mentioned are rudimentary lumbar ribs, thickening of the point or body of a transverse process of a lumbar vertebra, portions of a callus from a fractured rib, calcareous deposits in costal cartilage, calcareous incrustations in connective tissue, and calcified appendix epiploica. Tumors of different kinds may interfere, such as hypernephroma and carcinoma of the kidney, carcinoma of the head of the pancreas, calcified uterine myomata, calcified ovary, extrauterine pregnancy, calcified dermoid cyst, small cysts in the broad ligament, and skin tumors, such as nævi and warts.

If one stops to consider all these sources of error one may be appalled, but the fact still remains that "radiography in the hands of an experienced investigator represents our best means of diagnosis in nephrolithiasis, because it is the most certain and most delicate of all the examination methods here grouped together, and at the same time is harmless."

TREATMENT

Internal treatment. Internal treatment should be given if the radiogram shows the stones to be so small as to pass per vias naturales. Internal treatment is also indicated during an attack of colic so long as the urea excretion is undisturbed and no symptoms of pyelonephritis appear. A larger stone will pass the ureter in woman than in man.

Dietetic treatment. Large amounts of water should be taken (200–300 cc. every 2 or 3 hours); mineral waters, such as Contrexéville, Vittel, Vichy, etc., are used. Anything, such as lemonade, may be given so that the taste will not become unpleasant through long use. The diet should be meager and mixed. In uric acid diathesis all purin containing food such as liver, kidney, sausage, etc., should be forbidden. In oxaluria, spinach and strong teas should be given only in small amounts, and magnesium salts given. A steadily alkaline urine can soon lead to formation of concrements in which cases urotropin, salol, etc., are indicated. As prophylaxis, drinking of water, regulation of the bowels, and gymnastics are indicated. The internal treatment is only mentioned in the article and one is referred to works on internal medicine.

Surgical treatment. About 50 to 60 per cent of all cases of outspoken symptoms of nephrolithiasis recover through passage of the stone and without surgical intervention.

Indications for operation. Relative indications:

1. Large stones in the kidney.
2. Stones which completely or almost completely obstruct the ureter.
3. Continuous hæmorrhage.
4. In attacks of colic which frequently recur and are very severe.
5. In acute infection of the kidney which contains the stone.
6. In chronic suppurative processes in the kidney.
7. In renal fistulæ which resist treatment.

Vital indications:

1. Menacing hæmorrhage.
2. Anuria calculosa.
3. Acute pyelonephrosis.
4. Chronic pyelonephrosis.
5. Malignant disease of the kidney, such as tumors or tuberculosis.

Not rarely pain and urinary disturbances are so great as to cause operative interference. If the loss of blood is so great as to cause severe anemia, either by amount or by frequent recurrence, the case should be operated. Bladder tenesmus indicates the presence of clots in the bladder and hence is an indication for immediate intervention. In dealing with these cases the operation should be as bloodless as possible, and hence the kidney parenchyma should not be attacked unless it is absolutely necessary. If pyelotomy is impossible, nephrectomy should be done if the anemia is very severe, the kidney being removed unopened and of course provided the function of the other kidney is intact.

Ureteral stone. Unilateral surgical intervention is indicated if the stone be so large that it will not pass, if there is ureteral stenosis, infection, or the other kidney is not sufficient to carry on the renal function. In this condition the trouble lies in the boundary cases. In a ureter which has previously passed no stone, and hence is less likely to be the seat of stricture, there is more likelihood of the stone passing. Even though the stone be small, if the pain is unbearable and there is continued hæmorrhage, surgical intervention should be resorted to. If the ureter be long obstructed, degeneration of the epithelium of the kidney and infection of that organ are likely to occur. The attempt should first be made to dislodge the stone by ureteral catheterization, then if this is not possible, ureterolithotomy should be done. This should be simple if the kidney is intact. If the kidney, however, contains other stones, infection, or hydronephrosis, a nephrotomy should be done. If these processes be far advanced the kidney should be removed.

Bilateral ureteral stone (anuria calculosa). The principles of treatment are the same as in unilateral calculus. As in this we must form our judgment after careful estimation of the case with cystoscopy and radiography. Immediate operation is indicated, since the majority of the cases of anuria die in 7 to 10 days, and every hour adds danger. We may try to dislodge the stone by means of cystoscopy and ureteral catheterization, or if this proves fruitless we must resort to more active operative procedures. If the stone is movable in one or both ureters, it may be removed from above; if not the ureter must be opened. Nephrostomy of the sound kidney is often the operation to be preferred.

Never wait longer than 48 hours. Nephrectomy must depend upon the condition of the other kidney.

Ureteral stricture plays a more important rôle in these cases than has ordinarily been accorded it. The stricture may be congenital, or due to scar formation, or due to contracted scar outside the ureter. The stricture may be multiple and the stones be strung along the ureter like a string of beads. The scars are less severe than congenital narrowings. After pyelotomy or nephrostomy retrograde catheterization of the ureter may be resorted to, to determine the size and extent of the ureter, at times after this the stone may be removed from below. Occasionally internal ureterotomy may be done, but in the majority of cases nephrectomy must be resorted to.

For stone in the pelvis, pyelotomy is confined to aseptic or very slightly infected cases. For calyx stone, nephrolithotomy is usually the operation of choice. Parenchyma stones require partial nephrolithotomy.

In infection of the kidney with obstruction present, if the infection be slight, ureterolithotomy should be performed, but if it be severe, nephrostomy, followed later by ureterotomy. If no obstruction be present, the treatment will depend upon the degree of the infection; it may be conquered by irrigation through a ureteral catheter but it is much more likely that a nephrolithotomy will have to be performed. In very severe cases of chronic pyonephrosis the decision between nephrostomy and nephrectomy must be made. In the border cases, nephrectomy should be preferred. Of course in these cases we must always take into consideration the condition of the other kidney. If only part of the kidney is affected, the other part being relatively free, a partial resection of the kidney may be done. Paranephritic or paraureteral abscess must of course receive thorough drainage through the lumbar region.

Indications for the single surgical procedures: 1. Cystoscopic treatment. By means of a ureteral catheter, oil, salt solution, or glycerine may be injected in order to loosen a stone in the ureter. The results thus obtained may be due to dislodgment of the stone by the presence of the catheter. Occasionally dilatation of the ureter has been attempted and anuria has been stopped by injections into the non-stonebearing ureter.

Simon has introduced the finger through the female urethra and loosened a stone, but such marked dilatation of the urethra not infrequently results in permanent incontinence of urine.

2. Ureter operations. These may be classified as follows: (*a*) transvesical ureterolithotomy, (*b*) transperitoneal ureterolithotomy, (*c*) extraperitoneal ureterolithotomy. Either (*b*) or (*c*) may be subperitoneal or paraperitoneal.

The transvesical operation may be carried out by means of an epicystotomy and is of only slight practical value. A vaginal cystotomy is sometimes used to remove stones from the lower part of the ureter. This operation is chiefly of historic interest. The transperitoneal ureterolithotomy is indicated only where no infection exists.

A stone in the broad ligament has been removed by vaginal laparotomy, and stones in the ureter have been removed through the vagina, rectum, and even perineum. The dangers of rectal ureterolithotomy are rectal fistula, wound of the seminal vesicles, hæmorrhage, and insufficient field for operation. Kraske's sacral route, removal of the coccyx, and parasacral incision have been used. The extraperitoneal (paraperitoneal) ureterolithotomy is the one commonly used. Of the kidney operations pyelolithotomy and nephrostomy are frequently employed.

Ureterolithotomy. The vesical ureterolithotomy above the symphysis is the normal operation for calculi which at highest lie 3 cm. above the vesical opening of the ureter. In 14 cadavers on which the examination was made it was found that the distance from the vesical opening of the ureter to the part of this organ covered by the peritoneum was on the average 34 mm. in the male and 32 mm. in the female. One can therefore incise the ureter to the distance of 25 mm. from the vesical orifice without danger of entering the peritoneal cavity. Exceptions to this are when the stone is submucous or lies in a congenital cyst or diverticulum. In following this method the vesical opening must be enlarged before attempt is made to remove the stone or the latter may be pushed up out of reach. The prognosis in these cases is good. In women the vaginal route may be used if the stone can be palpated per vaginam. In this way stones as high as 5 to 7 cm. from the bladder may be removed. The danger of ureterovaginal fistula after this operation is great and its repair difficult, because of the shortness of the fistular tract.

The usual operation in ureteral stone is extraperitoneal ureterolithotomy. One must be careful not to nick the peritoneum. If manipulation displaces the stone downward it may be removed through the bladder or vagina, aided by pressure from above through the original wound. As to the necessity of suturing the wall of the ureter opinions differ. Urinary fistula is, however, uncommon and may be caused by a ureteral stricture below the point of incision. The prognosis of this operation is good, having a mortality of only one-half of one per cent.

Pyelolithotomy is indicated where the radiogram shows a stone which is too large to pass the ureter. If the stone lies deep in the calices a nephrotomy is to be preferred. If the stalk of the kidney is short a pyelotomy should not be done, because of the technical difficulties. The advantage of pyelotomy over nephrotomy in these cases is its conservative character. But little blood is lost and almost no damage is done even though a horseshoe kidney is present. A disadvantage lies in the inability to properly examine the rest of the kidney for stones.

Pyelotomy shows also a greater tendency to urinary fistula (22 per cent of cases). The large number of fistulæ reported may be due to the fact that most of the reports came at a time when infected and delayed cases were frequent. Technically, one must avoid the renal artery, which can be so various in its distribution, and must attack the posterior wall of the pelvis. The opening must be sufficiently large to deliver the unbroken calculus through it. The necessity of suture is still an undecided question. Dangers come from disturbance of function hæmorrhage, and infection. The future of pyelotomy is greater because of the development of radiography.

Nephrolithotomy. Indications:

1. Parenchyma stone.
2. Multiple stones in calices.
3. Stones in calices of such a nature that they cannot be removed unbroken by pyelotomy without laceration of kidney tissue.
4. A stone in the pelvis which cannot otherwise be removed except with laceration of the calices.
5. A stone in pelvis which cannot be removed by pyelotomy because stalk of kidney is too short.
6. Pyelitis or pyelonephritis.
7. Chronic suppurative processes of kidney.
8. In high lying ureteral stone with pyelitis or pyelonephritis.

Nephrotomy. Indications:

1. In anuria calculosa:
   a. As an exploratory operation.
   b. In manifest uremia.
   c. If the resistance of the patient be so lowered that a nephrolithotomy is to be feared.
   d. If diuresis does not set in in a solitary horseshoe shaped kidney after pyelolithotomy or ureterolithotomy.
2. In acute pyelonephritis or exacerbations, if the stone is relatively inaccessible.

Nephrectomy. Indications:

1. In intrarenal hæmorrhage which cannot be checked with certainty by other means.
2. In acute unilateral pyelonephritis with threatening sepsis.
3. In hydronephrosis with complete loss of parenchymal tissue.
4. In fatty stone kidney.
5. In chronic suppurative processes:
   a. If the kidney parenchyma is nearly all destroyed.
   b. If the cavity of the kidney is diffusely encrusted with calcareous matter.
   c. If the pus cavities cannot be thoroughly drained by nephrotomy.
   d. If it seems probable that nephrolithotomy will leave a permanent urinary fistula.
6. In chronic fistulæ of the kidney, pelvis, or ureter which cannot be healed.
7. In malignant disease, such as malignant tumor or tuberculosis in the stonebearing kidney.

Hæmorrhages in or after nephrolithotomy appear to be more frequent in proportionately sound kidneys. As a rule Floderus has obtained satisfactory results by careful apposition of the sides of the kidney. If nephrectomy is necessary, it should be carried out before the kidney is opened in order to prevent loss of blood and wound infection. Acupuncture is not advisable. In order to prevent formation of urinary fistula, instead of clamps it is well to use an elastic ligature on the ureter. It is well in every kidney or ureter operation for nephrolithiasis to sound the ureter after removal of stone. If the sound encounter hindrances their causes must be determined and removed.

Prognosis. It is impossible by statistics to arrive at a definite conclusion of the mortality rate under varied conditions. The chief causes of death are uremia, hæmorrhage, and infection. Uremia is usually due to defective kidney, especially in anuria calculosa. As a result the prognosis of bilateral nephrolithiasis is rather earnest. Severe hæmorrhages rarely come in the operation itself, but usually on removal of a tamponade. The dangers of infection are from infection of the perirenal tissues or peritonitis. Shock or collapse after operation is relatively frequent. Intercurrent disease, such as amyloid degeneration, may cause death. Recurrence of the disease is the thing most to be feared and figures largest in the mortality statistics. Recurrence rarely occurs if the urine is kept acid and a proper diet is adhered to. The causes of recurrence are infection or the leaving behind of foreign bodies, such as blood clots, sponges, or pieces of thread.

This exhaustive article is accompanied by a most complete list of references, sixteen plates, and a report of fifty-seven cases in detail.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF ORTHOPEDIC SURGERY

UNDER THE CHARGE OF

JOHN RIDLON, M. D.

JOHN L. PORTER, M. D. — A. STEINDLER, M. D.

E. W. RYERSON, M. D. — H. WINNETT ORR, M. D.

Pott's Paraplegia. C. F. PAINTER AND GEORGE C. MORSE. *Am. Jour. Orthopedic Surgery*, November, 1910.

Painter and Morse have discussed the various theories as to the cause of paraplegia occurring in tubercular spondylitis, and present the result of their investigations, both clinical and pathological, bearing upon these theories, with their conclusions.

They find that the following eight hypothetical causes have been advanced to explain the appearance of paralysis:

1. Narrowing of the lumen of the spinal canal.
2. Constriction of the cord by the sharp angularity of the canal.
3. Circulatory disturbances in the cord.
4. Bony sequestra compressing the cord.
5. Sclerosis of the cord secondary to long continued compression.
6. Cold abscess between the dura and the cord.
7. Extension of granulation tissue from the bony focus into the vertebral canal.
8. Penetration of the dura by granulation tissue and consequent infiltration of the pia and neuroglia.

Their studies included 29 autopsies, 4 laminectomies, and a large number of pathologic specimens in American and foreign museums, besides the clinical examination and histories of forty-eight paraplegics with Pott's disease.

In addition, correspondence was had with some of the prominent neurologic surgeons. They have found that practically all of the causes suggested above, except possibly the 2d and 3d do occur in certain cases of Pott's paraplegia and may account for the cord symptoms, but they conclude that "the extension of granulation tissue to the space between the dura and the bony canal is in all probability the most usual explanation of the paraplegic phenomena. This was most often in evidence as the causative factor even in the museum specimens which have been studied and at autopsy."

As regards clinical evidence they concluded that both the onset and the recovery from paraplegia "is more consistent with the hypothesis of a granulation tissue compression of the cord, generally extradural in location."

As regards treatment the authors say:

"In most instances, therefore, fixation is the essential factor in treatment and in the larger percentage of cases will be effective in bringing about a cure of the symptom, provided efficient constitutional treatment is supplied. The necessity for operative treatment is of the rarest occurrence, and in the belief of the writers should never be employed if one can be satisfied that the pressure which causes the trouble is extradural."

"As to the assertion, chiefly made by the neurologists, that persistence of extradural pressure is liable to produce sclerosis of the cord, the writers can find no evidence in support of this except in cases where the disease has already penetrated the dura and gotten into the pia and the substance of the cord itself.

"Penetration of the dura and involvement of the structures above mentioned is dependent upon the activity of the tuberculous process and not upon simple, long-continued contact of a tuberculous pannus with the dura.

"The presence of spastic contractures of the hamstrings, adductors of the thigh and foot, and extensors of the toes, generally marks the invasion of the pia and cord, and in these cases laminectomy can do no good. Where such extreme symptoms are not present the pressure is probably extradural and laminectomy is not needed."

JOHN L. PORTER.

Fracture of the Knee Cap. MANNINO. *Gaz. Internat. di Medic.*, No. 3, 1910.

Subcutaneous transverse fractures of the patella, without lesion of the ligamentous apparatus and without any or with but little diastasis of the fragments, should be treated with massage and early mobilization. The subcutaneous transverse or comminutive fractures, however, with extensive tears and considerable diastasis of the fragments, as well as the open fractures, should be sutured or wired, but massage and mobilization should follow the operation in a short time. The best material for suture is strong silver wire.

A. STEINDLER.

Injuries to the Semilunar Cartilages of the Knee Joint. K. KOERBEL. *Deutsche Zeitschr. f. Chir.*, b. cvi, h. 1–3.

Twenty-six cases are reported. In the majority of cases there was not a dislocation but a rupture of the cartilage. It was found most frequently divided in two sections by a longitudinal tear, ending just before the anterior and posterior insertion of the cartilage. The peripheral part remains in connection with the capsule, while the inner half of the cartilage is being displaced towards the interior of the joint, usually inside of the internal condyle of the femur.

Koerbel does not share the opinion of various observers, that every case of this kind should be operated upon. Many cases show a perfect functional result, which are treated conservatively by rest, fixation for several weeks, later massage, and exercise. An attempt at a conservative treatment should be made in all recent cases, although the operation may give quicker results. The latter is indicated in habitual cases, in which conservative treatment is of no avail. In five cases excision of the separated piece was performed. Twelve times the entire cartilage was removed. The result was satisfactory in all cases, but Koerbel gives the removal of the separated piece only the preference, as the operation is less extensive. After operation the patient is kept in bed for eight to fourteen days; he is dismissed from the hospital after ten to twenty days. After four weeks he is perfectly able to assume his work. The joint is opened by a longitudinal incision in front of the ligamentum collaterate tibiale, access to the joint being obtained by flexion and outward rotation. Sawing through the patella or chiseling off the tibial tubercle is unnecessary. A. STEINDLER.

Immediate and Permanent Results of Resection of the Knee in Adults for Tuberculous Affections. P. CALCAGNI. *Gazetta Internationale di Scienze Med.*, February, 1910.

The author arrives at the conclusions that the danger of generalization of tuberculosis and of consecutive meningitis following the resection of the knee is vastly exaggerated. The tuberculous process can be cured completely by resection, even in severe cases in which an amputation might come into consideration. The resected limb will grow, a progressive shortening not being a necessity by any means, unless the epiphyseal cartilage has been removed entirely. Regarding the deformities which so often follow the resection, they are not due to the operative interference but rather to the negligence of the patient, who often fails to wear the supporting splint or brace for sufficient length of time. These braces should be left on also at night time and should be worn during the entire period of growth. If the tuberculous focus has healed, correction of the deformities by osteotomy will not resuscitate the tuberculosis nor will it cause a meningitis to develop.

ARTHUR STEINDLER.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF GYNECOLOGY

UNDER THE CHARGE OF

J. CLARENCE WEBSTER, M. D. — E. C. DUDLEY, M. D.
J. C. HOLLISTER, M. D. — GEO. DE TARNOWSKY, M. D.
HELIODOR SCHILLER, M. D. — CAREY CULBERTSON, M. D.

The Ureter in Cancer of the Cervix Uteri. ARCHIBALD LEITCH. *Journal of Obstetrics and Gynecology of the British Empire*, April, 1910.

The author's work as pathologist to the Caird Cancer Research Laboratory, Dundee, and the postmortem records of the Middlesex Hospital comprise the basis for his article on the involvement of the ureter in cervical cancer. His conclusions are:

1. Involvement of the ureter is the commonest occurrence in postmortem examinations of cancer of the uterus. It can be demonstrated also in operable cases.

2. This involvement consists in the production of stricture frequently (a) by contraction of growth in the surrounding parametrium; (b) by invasion of the ureter wall; and sometimes (c) by fibrosis in the parametrium, due either to chronic inflammation or to the reaction to cancer cells which have disappeared locally.

3. The ureteral wall may be invaded by cancer directly from the surroundings, the invasion being sometimes evident on naked eye examinations, at other times, even when extreme, demonstrable only by the microscope.

4. Lymphatic permeation of the ureter does occur, and the lymphatic vessels of the ureter and parametrium probably communicate.

5. The nature of the surrounding tissue in the parametrium, the open texture, the proximity of the principal lymphatic vessels from the uterus, the danger of invasion and the peculiarity of the blood supply render resection of the parametrial portion of the ureter advisable when the parametrium is invaded. CAREY CULBERTSON.

The Ovary, an Etiologic Factor of Uterine Hæmorrhage (Zur ovariellen Ætiologie uteriner Blutungen). DR. KAJI. *Monatsch. für Geburts. und Gynæk.*, xxxii, h. 4.

In most cases of uterine hæmorrhage the etiology is indeed very plausible, the presence of a benign or malignant tumor, of pregnancy, of a threatening or imperfect miscarriage, of inflammatory conditions in and around the uterus will readily explain it. However, there are cases in which all the conditions mentioned are absent and in which the most exact examination cannot detect any etiologic cause for the hæmorrhage.

The author examined six such cases. In all of them the cause of the hæmorrhage was not recognizable. Curettement, cauterization, gave no result. The microscopic examination of the pieces taken from the curettement showed neither pregnancy nor tumor, nor even the physiologic changes normally found in the mucosa of the uterus. Vaginal extirpation was performed in all cases. None of the patients were below 40. Neither the microscopic examination of the mucosa nor that of the muscularis of the uterus showed any pathologic condition, but in all the six cases the ovaries showed pathologic changes, macroscopically and microscopically or only microscopically; for instance, small cystic degeneration, a very much thickened albuginea, changes in the wall of the vessels. These changes, in no way characteristic, yet present without exception in all the six cases, strengthen the supposition that the ovaries in some cases are directly responsible for the existing uterine hæmorrhage. HELIODOR SCHILLER.

Adenomatosis Vaginæ: a Hitherto Undescribed Condition. VICTOR BONNEY AND BRYDEN GLENDINING. *Proc. Roy. Soc. Med.*, 1910, ix.

The writers describe a case of vaginal disturbance in the nature of a thick viscid irritating discharge without other symptoms, which had continued over many years. The vaginal mucous membrane was inflamed, contained small cysts, and exuded in large quantities, a thick fluid, like the white of an egg.

The pathological report was as follows:

The vaginal surface exhibits a poorly stratified epithelium, reduced in many places to the thickness of a single cubical cell. The tissue of the vaginal wall underlying it consists of a fibromuscular stroma in which the muscular elements are predominant though illformed. Inbedded in this stroma, and inwards throughout a large proportion of the thickness of the section, are numerous glandular spaces. These glands are everywhere lined by a single layer of tall columnar epithelium, actively mucinogenetic, as proved by their reaction to mucicarmine. They are small and most discrete imme-

diately under the epithelium, being here separated from one another by considerable masses of the stroma, whilst deeper down they become exceedingly numerous and large, so that over considerable areas practically little interglandular connective tissue is seen. With increase in size their form becomes irregular, owing to infoldings of the wall, which appear in section as simple papillary processes. Some of them have been converted into retention cysts. Here and there the communication of these glands with the surface can be demonstrated, the columnar cells lining the ducts of exit becoming continuous with the superficial squamous or short epithelium. At these points all gradations between the two types of cell can be traced.

The surface epithelium at intervals exhibits small solid downgrowths, which here and there appear to be excavating to form glandular crypts.

The cellular elements of the interglandular stroma are chiefly ordinary connective tissue cells, with an oval or spindle shaped nucleus. No plasma cells can be demonstrated by Pappenheim's or Bonney's staining methods, and very few lymphocytes and no polynuclear leucocytes are present.

Weigert's stain reveals complete absence of elastic fibers under the surface epithelium, but it is present in about normal proportion around the vessel walls. Its connection to the glands varies. Some of them have a remarkably complete and well formed envelope, whilst others in immediate proximity to them show complete absence of any such investment.

The writers think that the source of the disturbance lay in a congenital growth abnormality of the vaginal epithelium which was excited by inflammation. C. G. GRULEE.

The Problem of the Isthmus of the Uterus (Zur Frage des Isthmus Uteri). O. BÜTTNER. *Beitr. z. Geb. und Gyn.*, b. xvi, h. 1.

The question whether the lower uterine segment is formed of the corpus or the cervix is still unsettled. Recently Aschoff claims that neither one nor the other takes part in its formation but that the lower uterine segment is formed of the isthmus, a part of the uterus with distinct anatomical as well as functional qualities. According to Aschoff the isthmus has a mucosa like the corpus, while macroscopically it has the character of the cervix. It extends between the os internum anatomicum and the os internum histologicum. In these conclusions he was upheld by the study of the morphology of the cells of the mucosa. However, according to Büttner the morphology of the cells is not sufficient to define the true nature of a cell. A much better method of recognizing the true character of a cell is the differential chemical or tinctorial method. After exhaustive studies Büttner concludes that the basal part of the corpus epithelium never shows the typical mucin reaction, while the epithelial cells of the cervix show all over the protoplasm and a typical mucin reaction at all times. In this chemical method he finds a very characteristic differentiation between cervix and corpus epithelium. The reaction consists of first staining with "hemalaun" then with a concentrated mucin carmin solution — the mucin will appear bright red.

Sections stained in this way show often an epithelium giving the typical mucin reaction, an epithelium which we would have believed to belong to the corpus. This is especially the case in the so-called transitional layer of the mucosa, the lower border of the isthmus. But also the upper half of the isthmus often shows such cells, a condition which reduces the length of the isthmus considerably.

In two specimens which Büttner examined very carefully the mucosa of the part of the uterus which according to Aschoff and Pankow would belong to the isthmus, had all the characteristics of the cervix and in both the os internum anatomicum and the os interum histologicum were in identically the same place; in short there was no isthmus present in the sense of Aschoff. It must seem strange that a part of an organ which has such an important physiological action as the isthmus, should vary so much in size.

Taking this and the result of his examinations into consideration Büttner concludes that the assumption of Aschoff that the cervix is never used for the formation of the bed of the egg is very vague and that at least in a number of cases the lower uterine segment is formed of the cervix.

HELIODOR SCHILLER.

Casuistic Contribution to the Question of the Genesis of the "Mammæ Accessoriæ" and the So-called Mammæ of the Axilla without Nipple and Ducts in the Pregnant Woman (Kasuistische Beiträge zur Frage der Genese der Accessorischen Mammæ und der Sogenonten Achselhöhlen brust drüse ohne Warse und Ausführungs Gangs bei Wochnerinen). DR. KNAEBEL. *Monats. f. Geb. u. Gyn.*, b. xxxi, h. 5.

The author reports two cases and divides mammæ accessoriæ into the following classes:

1. Micrommæ or accessoriæ with typical nipples, gland tissue and excretoric ducts.

2. Pseudo mammæ, nipples without gland tissue and ducts.

Some claim besides these a third group.

3. Subcutaneous milk glands — glands without nipple or ducts.

These subcutaneous milk glands can be found only in the axilla. Investigators of late doubt whether these are milk glands but claim they are highly differentiated sweat glands. However, as there exists no real characteristic histological difference between a milk and a highly differentiated sweat gland, only an exact chemical examination of the secreted fluid to determine albumen and carbohydrates will solve this question.

Clinically these tumors are important on account of the possible development of malignant tumors in them. Some forms of brachial neuralgia, especially the one which seems aggravated during menstruation, might find in them their etiology. HELIODOR SCHILLER.

Principles and Experience in the Treatment of Extrauterine Pregnancy in the Early Months (Grundsatze und Erfahrungen in der Behandlung der Tubenschwangerschaft der früher Monate). H. FEHLING. *Archiv für Gynäkologie*, b. 92, h. 1.

A differential diagnosis between tubal abortion and tubal rupture is not possible except with the microscope. The two conditions are often combined. Rupture is due to a long continued disturbance of the tubal wall by embryonal elements. Rupture of the pregnant tube is nearly always accompanied by the escape of free hæmorrhage into the peritoneal cavity and acute anemia from which the patient will die unless operated upon. If, after rupture, the bleeding is not severe, the site of rupture may be closed by adhesion to the intestine or mesentery. If the patient is seen immediately after rupture, the diagnosis is easy; if seen after the rupture has been closed, a diagnosis is only possible at the time of operation.

It is not yet determined why a small tubal opening will bleed so profusely. In uterine rupture, the hæmorrhage is often moderate though the vessels are much larger. Fehling believes that in tubal rupture a substance is present that delays coagulation. Tubal abortion is nearly always followed by hematocele, either retro- or parauterine. It is plausible to consider that an ovum of a few days' development may be expelled into the abdominal cavity without further symptoms of free or sacculated hæmorrhage. If a hematocele is formed, it rarely ruptures, but heals spontaneously unless broken by a careless examination.

It is important to distinguish clinically between complete and incomplete tubal abortion. In the first instance, a woman, otherwise healthy, suffers from severe pain in the abdomen, becomes collapsed, and is acutely anemic. The pulse is rapid within two hours. The patient usually comes for operation within the first two days. In the second case, one obtains a history of amenorrhœa; then after a longer or shorter time, uterine bleeding recurs and may last for many weeks, thus simulating protracted abortion. Rarely one or two attacks of colic, usually a dull pain increased by exercise and exertion. Frequent bladder disturbances are common. The pulse rises gradually and the patient becomes bedridden. Temperature is slight.

Every case of tubal pregnancy with rupture or hematocele should be operated upon. The abdominal route is better. In large cities, the woman is to be taken to a hospital. Operation in the home is more difficult and the danger from sepsis is increased. It is well to remove as much of the blood as possible because it is entirely lost to the patient and further it offers a suitable media for the development of bacteria.

Hematocele is to be treated through the abdomen. The operator is at times undecided as to where the diseased tube is for it is a relatively common experience to find the hematocele on the opposite side. During a laparotomy, the surgeon can arrest the bleeding much easier, exsect the tube, and treat the other side if necessary. The vaginal route is not simple. Infection of the tissues is apt to occur and convalescence is retarded. Only when the hematocele is suppurating is posterior incision and drainage indicated.

Fehling has treated 170 cases during the last nine years at the Strassburg Klinik and 130 in Halle. Of the 170 cases, 43 were ruptures with free bleeding in the abdomen, 7 were ruptures of sacculated hæmorrhage, 93 were tubal abortions with hematocele formation, and 3 were hematocele which ruptured subsequently. The remaining 24 were operated upon before rupture. No mothers were lost in tubal abortion with hæmorrhage. Of the 50 ruptures with free abdominal bleeding, 7 died. Five died within two hours after operation and evidently could not be saved by any treatment. Of the remainder, one died of acute yellow atrophy of the liver and the other from general peritonitis from intestinal perforation.

The fact that only 22 out of 170 women had never been pregnant before does not speak well for the theory that infantile tubes are a potent etiological factor in extrauterine pregnancy. In nearly half of the cases where a careful examination was possible, the opposite adnexa were diseased — endosalpingitis, with closure of the tube, adhesions, hematosalpinx, small cysts, etc. In 54 out of 143 cases, the non-pregnant tube was removed. Conservative treatment of the other tube is indicated if the patient is young or has no children, but in the five cases in which Fehling made an artificial opening, he did not obtain favorable results. Only one woman became pregnant and she aborted early.

The author states that the tendency to extrauterine pregnancy is increased by the prevalence of gonorrhœal infection and unnecessary intrauterine manipulation during the labor. The manual removal of the placenta is especially pernicious. Patients who are free from gonorrhœa and who are properly cared for in labor are rarely subjects of extrauterine gestation. In 1,000 private cases, Fehling has met with only ten cases.

HERBERT M. STOWE.

BOOK REVIEWS

DIFFICULT LABOR. By G. Ernest Herman, F. R. C. P., F. R. C. S. London: Cassel & Company, Limited.

This work is a revised up to date treatise upon the pathology of obstetrics. The dogmatic way in which the author presents his subjects impresses the reader with the truth of his assertions, and while one might not entirely agree with some of the statements, his experience should be given great consideration. The treatment for instance, of accidental hæmorrhage, is not that of Dublin schools, nor does he believe in packing in placenta prævia, but these are differences which may be considered trivial.

The chapters upon the pelvis and pelvic deformities are considered more fully than is usually given to these subjects. The treatment of labor in contracted pelvis is also given much space and presented in such a lucid manner that it leaves nothing to be explained. The author does not deal with vagaries and the book is not weighted down with a large bibliography, but he presents solid facts, not tentative theories, for the reader's consideration.

The work is certainly worthy of recommendation.

C. E. PADDOCK.

DIAGNOSIS AND TREATMENT OF DISEASES OF WOMEN. By Harry Sturgeon Crossen, M. D. St. Louis: C. V. Mosby Co., 1910.

In this book the field of gynecology is adequately covered. The reader can not help but be impressed with the fact that Dr. Crossen is well abreast of the times and that he has succeeded in recording the recognized advancement made in gynecology to the present date. It is to be regretted that the author has not paid more attention to revising his somewhat unsystematic classification. Special stress has been laid upon the late methods of treatment and care after operative procedures, and there is an excellent appendix of formulæ indicated in the medical treatment of gynecological disorders. The author has carefully reviewed and minutely described Wertheim's operation and gives a forceful personal opinion of the limitations of this radical measure. The book is generously supplied with 750 illustrations, a large number of which have been taken under the author's personal supervision with the end in view of portraying the scientific manner of handling patients, which makes the book especially valuable to the student and to the general practitioner. The author has added to the value of the book by devoting the last chapter to "Medico-legal Points in Gynecology." Considerable detail has been given to citing numerous law suits that illustrate practically the legal status and the responsibility of the surgeon.

ROBERT T. GILLMORE.

THE PRACTICAL MEDICINE SERIES. VOLUME V, OBSTETRICS. Edited by Joseph B. De Lee, A. M., M. D., with the collaboration of Herbert M. Stowe, M. D. Chicago: The Year Book Publishers, 1910.

In this new volume of the Year Book Series the subject of obstetrics is presented in the manner which has distinguished the work of its joint authors, that characterized by painstaking care and elaborate literary research. As before, the subject matter is divided into four parts under the respective headings, pregnancy, labor, puerperium, and the newborn.

It is sufficient to say that the most recent advances are noted with considerable detail and that the most important contributions to all phases of the subject have been carefully abstracted to produce the present volume. This is particularly true of those sections devoted to the toxæmias of pregnancy and to operative procedures.

CAREY CULBERTSON.

FRACTURES AND SEPARATED EPIPHYSES. By Albert J. Walton, F. R. C. S. (Eng.), M. S. (Lond.), L. R. C. P., M. B., B. Sc. (Lond.), Surgical Registrar, London Hospital. New York: Longmans, Green & Co.; London: Edward Arnold, 1910.

This small treatise from the pen of one of our English confreres is designed to meet the requirements of students and house surgeons, and aims to deal with the practical aspect of fractures. Fractures of the skull and spine are purposely omitted as being beyond the scope of the book, which opens with a brief consideration of the etiology, varieties, symptoms, and pathology of fractures, with general methods of treatment and complications. The special fractures are handled very creditably, but the book could be greatly improved by abridging the text and adding to the illustrations, which are too few for a book on fractures. This altogether excellent little book can not be recommended for the use of American students on account of its lack of clear conciseness in the matter of treatment, for there is no question that we, on this side of the water, employ simpler methods of treatment to accomplish the same ends.

The author does not mention the Grossich iodin method of skin operation, but still scrubs his compound fractures with soap and water. Fractured

patella are still drilled and wired with heavy silver wire, a method which is becoming obsolete. On these points and others the book would gain by being brought up to date. While it adds nothing new to the already voluminous literature of fractures, the volume will find appreciation among the readers for whom it is written.

WILLIAM HESSERT.

A TEXT-BOOK OF BACTERIOLOGY. By Philip Hanson Hiss, Jr., M. D., and Hans Zinsser, M. D. New York and London: D. Appleton & Co.

This very excellent treatise deals with the fundamental laws and technique of bacteriology, as illustrated by their application to the study of pathogenic bacteria.

The necessity of familiarity with those laws is clearly set forth in the text and the application of the fundamental principles of bacteriology to therapeutics is clearly demonstrated.

The first section deals in general with biology of bacteria and the technique of bacteriological study, bringing out the latest methods of microscopical study and staining, and especially the bacteriological examination of material from patients.

Section two treats of immunity and infection, taking up in turn the fundamental factors of pathogenicity, the defensive factors upon the part of the animal organism, toxins and antitoxins, with their production and testing, Ehrlich's side-chain theory, technique of serum reactions, and opsonins.

Chapter twenty clearly points out the facts and problems of immunity in their bearing upon the treatment of infectious diseases.

Section three considers in a most concise and clear manner the various pathogenic micro-organisms, going into the special morphology, reproduction, chemical and physical properties, resistance, pathogenicity, immunization, etc.

Chapter forty-three is devoted to diseases caused by spirochætes, especially the spirochæte pallida, giving the various staining methods of tissues as well as of smears, also their demonstration by means of India ink.

Diseases of unknown etiology, viz., rabies, smallpox, acute anterior poliomyelitis, yellow fever, measles, scarlet fever, and foot and mouth disease, are brought up to date, as far as our knowledge of them is concerned.

The last section deals with agricultural and sanitation bacteriology showing the relation of bacteria to our food and environment.

An index of authors is also appended showing the many various works consulted in the preparation of the volume.

The book merits a wide circulation and close study.

H. A. POTTS.

DISEASES OF THE PANCREAS. By Eugene L. Opie, M. D. Second Edition. Philadelphia and London: J. B. Lippincott Company, 1910.

Among the volumes appearing from time to time which reflect credit upon the original investigations of modern students and serve to justify the assumption that medicine in the United States has taken a position of which every earnest student may be proud, is the second edition of Opie's work on the pancreas. It is a constant source of regret to every teacher that the literature is flooded with volumes which are simply compilations of observations already made by other authors upon some subject and to which they themselves add nothing.

As is known to all, the first edition of Opie's excellent work dealt largely with the investigations which he himself had made from the pathological laboratory side. This has now been amplified by extensive research of contemporaneous literature. The work has been enlarged to include a complete discussion of the various phases of the pathology and clinical aspects of all diseases of the pancreas, so that as the work now stands it is the most up-to-date and satisfactory résumé of our present knowledge of pancreatic diseases and should be in the hands of every practitioner of medicine and surgery.

The surgeon will be somewhat disappointed in that the surgical phases of the subject have not received an equal consideration with the pathological and medical. In this connection the recent clinical observation of Dr. Richter of fat necrosis associated with a perforating duodenal ulcer opens a new field for investigation and serves to emphasize the close relation between pathology and clinical observation that should always be held in mind by authors and students.

This volume of over 350 pages is excellently printed and should be a source of satisfaction to the author and to the publisher. It will undoubtedly take its place among the milestones of advance in American medicine. It is a pleasure to recommend the book.

BOOKS RECEIVED

DIE ERWEITERTE ABDOMINALE OPERATION BEI CARCINOMA COLLI UTERI. By Prof. Dr. E. Wertheim. Berlin and Vienna: Urban & Schwarzenberg, 1911.

PLASTIC AND COSMETIC SURGERY. By Frederick Strange Kolle, M. D. New York and London: D. Appleton & Company, 1911.

TRANSACTIONS OF THE FOURTH INTERNATIONAL SANITARY CONFERENCE OF THE AMERICAN REPUBLICS. Published by Pan American Union, Washington, D. C.

A TEXT BOOK OF GYNECOLOGICAL SURGERY. By Comyns Berkeley, M. D., and Victor Bonney, M. S. London and New York: Cassell & Company, Ltd., 1911.

ATLAS OF MICROSCOPIC DIAGNOSIS IN GYNECOLOGY. By Dr. Rudolf Jolly, translated by P. W. Shedd, M. D. London: Rebman, Limited, 1910.